

Decision Making Techniques (Case Study-Based Approach)

3

This Module Includes

- 3.1 Decisions Involving Alternative Choices**
- 3.2 Pricing Decisions and Strategies**
- 3.3 Transfer Pricing**
- 3.4 Relevant Cost Analysis**
- 3.5 Target Costing**
- 3.6 Product Life Cycle Costing**
- 3.7 Asset Life Cycle Costing**
- 3.8 Decision Making using Probability**

Decision Making Techniques (Case Study-Based Approach)

SLOB Mapped against the Module

1. Proficient knowledge on tools and techniques Marginal Costing, Transfer Pricing, Target Costing, Life Cycle Costing, etc.
2. Application of various techniques of Strategic Cost Management across the manifold enterprises.
3. Developing business level Cost Management Strategies for gaining Competitive Advantage.

Module Learning Objectives:

After studying this module, the students will be able to –

- ⊙ Proficient knowledge on tools and techniques Marginal Costing, Transfer Pricing, Target Costing, Life Cycle Costing, etc.
- ⊙ Application of various techniques of Strategic Cost Management across the manifold enterprises.
- ⊙ Developing business level Cost Management Strategies for gaining Competitive Advantage.

Decisions Involving Alternative Choices

3.1

Decision Making

Decision making is the outcome resulting from the process of evaluation of the available alternatives and choosing the best. Some instances of alternative choice decisions are: make or buy, change the product-mix, take or refuse orders, place special orders, export versus local, shut down or continue, expand or contract, own or lease, retain or replace, repair or renovate, now or later, change versus status quo, slower or faster, select sale territories, replace present equipment with new machinery, sell at split-up point or process further, etc.

A famous American poet, Robert Frost, wrote, “Two roads diverged in a wood, and I took the one less travelled by, and that has made all the difference.” But unfortunately, not every decision is as simple as “Let’s just take this path and see where it goes,” especially when a decision is related to business. Whether you manage a small team or are at the head of a large corporation, your success and the success of your company depend on you making the right decisions—and learning from the wrong decisions.

That said, the business decision-making is a step-by-step process allowing professionals to solve problems by weighing facts, examining alternatives, and choosing a path from there. This defined process also provides an opportunity, at the end, to review whether the decision was the right one. Though there are many slight variations of the decision-making framework floating around in business textbooks, and in leadership presentations; professionals most commonly use the following seven steps.

- 1. Identify the Problem:** In order to make a decision, you must first identify the problem you need to solve or the question you need to answer. Clearly define your problem. If you mis-identify the problem to be solved, or if the problem you’ve chosen is too broad, you’ll knock the decision train off the track before it even leaves the station. If you need to achieve a specific goal from your decision, make it measurable and timely.
- 2. Gather Relevant Information:** Once you have identified your problem for decision making, it’s time to gather the information relevant for the purpose. Do an internal assessment, seeing where your organization has succeeded and failed in areas related to your decision. Also, seek information from external

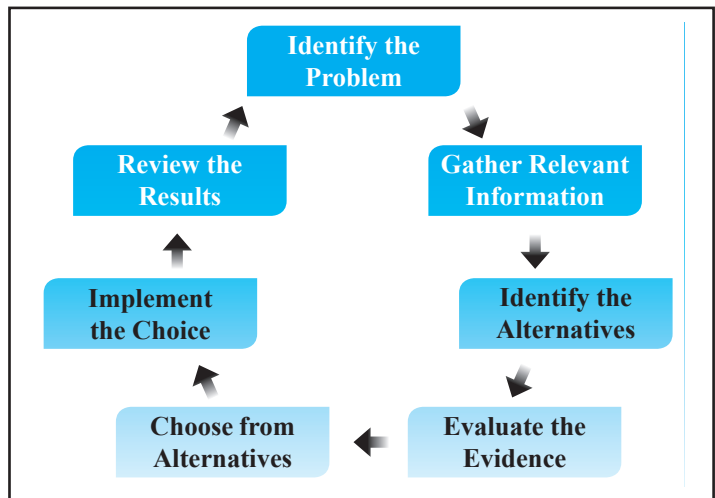


Figure 3.1: Steps of Decision making

sources, including studies, market research, and, in some cases, evaluation from external consultants. Keep in mind, you can become bogged down by too much information and that might only complicate the process.

- 3. Identify the Alternatives:** With relevant information now at your fingertips, identify possible solutions to your problem. There is usually more than one option to consider when trying to meet a goal. For example, if your company is trying to gain more engagement on social media, your alternatives could include paid social advertisements, a change in your organic social media strategy, or a combination of the two.
- 4. Evaluate the Evidence:** Once you have identified multiple alternatives, evaluate the evidence for or against said alternatives. See what companies have done in the past to succeed in these areas, and take a good look at your organization's own wins and losses. Identify potential pitfalls for each of your alternatives, and weigh those against the possible rewards.
- 5. Choose from Alternatives:** This is the part of the decision-making process where you actually make the decision. Hopefully, you've identified and clarified what decision needs to be made, gathered all relevant information, and developed and considered the potential paths to take. You should be prepared to choose.
- 6. Implement the Choice:** Once you've made your decision, do act on it! Develop a plan to make your decision tangible and achievable; and then assign tasks to your team.
- 7. Review the Results:** After a predetermined amount of time—which you defined in step one of the decision-making process—take an honest look back at your decision. Did you solve the problem? Did you answer the question? Did you meet your goals? If so, take note of what worked for future reference. If not, learn from your mistakes as you begin the decision-making process again.

Relevant to recall is that Strategic Cost Management encompasses the entire spectrum of value addition process which involves taking crucial decisions. Here, we get to understand vital concepts relating to decision making tools and techniques.

Cost Behaviour

Cost Behaviour refers to the changes in input costs in relation to the level of production. Costs may increase or decrease proportionately with increasing or decreasing level of production, such costs being called variable costs; or they may not change at all with the increase or decrease in the level of production, such costs being termed as fixed costs. Some costs, semi-variable in nature, may have both variable and fixed elements. Such of these costs may increase more or less than in direct proportion, and there may be step changes in costs. To a large extent cost behaviour may be dependent on a relevant range of production capacity and the time period assumed for the purpose.

Each product or service has variable costs that are incurred when the product is produced. The examples cover Raw Material, Direct Wages, Power, Fuel, Chemicals & Other Consumables, Packing Material, Sales Commission, Distribution Expenses, and so on. Each business has certain fixed costs which must be paid for every month, whether or not any production takes place. The examples include Employee Cost, certain categories of Administrative Expenses, Period related Contractual Expenses, Interest Burden on fixed loans, etc.

There are semi-variable costs that go up or down depending on the level of business activity. The examples that can be stated are Stores & Spares, Repairs & Maintenance, Certain items of Administrative & Other Expenses, etc. Semi variable costs can be segregated into variable and fixed elements by adopting an appropriate statistical technique.

Cost is a fact, and so is the Cost Behaviour. Analysis of Cost Behaviour is the key for effective Cost Control. Proper segregation of costs into variable and fixed elements enables adopting relevant control tools and techniques.

Variable Costs are controlled by means of standards at the operational level whereas fixed costs are controlled by means of budgets at the strategic level. Variable Costs are prone to control even at the lower level; whereas Fixed

Costs are prone to better controls from the higher level. It is a proven experience that some of the fixed elements too can be converted into variable elements through long term strategic progressions.

The main objective of any costing system is to determine scientifically the cost of a product or service. Costs are of various kinds as may be detailed in a cost sheet. But all of them can be segregated into two distinct categories, viz. direct costs and indirect costs.

Direct costs are the costs which are traceable to the products or the services that are being offered. On the other hand, Indirect costs, which are traditionally called ‘overheads’, are not traceable to the products or services. Hence these overheads are first identified, classified, allocated, and apportioned to a convenient cost centre, reapportioned to production centres and finally absorbed by the cost units i.e., the products or services.

Direct costs have traditionally been the target of management’s scrutiny and evaluation. Indirect costs, on the other hand, have not had that level of scrutiny they deserve. Indirect costs get pooled at the cost centre level. The problem associated with such a pooling is that it is very difficult to have the visibility to know what costs are truly necessary and what are not. The lack of adequate visibility impaired the level of scrutiny of indirect costs.

Charging the direct costs to the products is comparatively simple and can be done with remarkable accuracy. Broadly speaking, all the direct costs are variable by nature whereas all the indirect costs are subject to multiple behaviour patterns. The following table provides some examples relating to the general behaviour pattern of elements of cost.

General Behaviour Pattern of Elements of Cost

Item	Traceability	Behaviour
Raw Materials	Direct	Variable
Process Materials and Chemicals	Direct	Variable
Utilities (Power, Fuel, etc.)	Direct	Variable
Direct Employee Cost	Direct	Variable
Direct Expenses	Direct	Variable
Consumables, Stores & Spares	Indirect	Semi Variable
Repairs & Maintenance	Indirect	Semi Variable
Quality control Expenses	Indirect	Semi Variable
Research & Development Expenses	Indirect	Discretionary
Technical know-how Fee /Royalty	Indirect	Contractual
Depreciation / Amortization	Indirect	Fixed
Other Production Overheads	Direct (Eg.Machinery hired charges) / Indirect (Eg. Repairs & Maintenance)	Variable / Semi Variable
Primary Packing Cost	Direct	Variable
Administrative Overheads	Indirect	Semi Fixed
Secondary Packing Cost	Indirect	Variable
Selling and distribution overheads	Direct (Eg.Sales Commission) / Indirect (Eg. Travelling Expense)	Variable / Semi Variable
Interest and Financing charges	Indirect	Semi Variable / Fixed

The concept of Contribution

Marginal costing technique has given birth to the concept of contribution wherein contribution is calculated as sales revenue less variable cost (marginal cost). Contribution may be defined as the profit before the recovery of fixed costs. Contribution is excess of the Sales Value over the Variable Cost. It represents the margin available to meet the Fixed Costs. Excess of Contribution over Fixed Cost denotes the Profit. The ratio of Contribution to Sales is known as Profit Volume (PV) Ratio. We, thus, have the derivations:

$$\begin{aligned} \text{Contribution} &= \text{Sales} - \text{Variable Costs} \\ \text{Profit} &= \text{Contribution} - \text{Fixed Costs} \\ \text{Profit Volume Ratio} &= (\text{Contribution} / \text{Sales}) \times 100 \\ \text{Sales} &= \text{Contribution} / \text{Profit Volume Ratio} \end{aligned}$$

Fixed costs will be the same for any volume of sales and production provided that the level of activity is within the ‘relevant range’; Revenue will increase by the sales value of the item sold; Cost will increase by the variable cost per unit and Profit will increase by the amount of contribution earned from the extra item. The total contribution margin generated by an entity represents the earnings available to pay for the fixed expenses and to pool into the profit.

Example 1

ABL manufactures a high-end tractor viz. ‘Model T’. The contribution analysis of the tractor for a month is furnished in the table that follows.

ABL: Contribution Analysis of ‘Model T’ for the month of

Serial	Particulars	Data
1	Sales (Number)	900
2	Sales	
	i. Selling Price (₹ / Piece)	7,00,000
	ii. Sales (₹ Lakhs)	6300.00
3	Variable Costs (₹ Per Piece)	
	i. Raw Material	4,34,000
	ii. Variable Expenses	1,26,000
	iii. Sub Total (i + ii)	5,60,000
	iv. % to Selling Price	80.00
4	Contribution	
	i. ₹ Per Piece (2(i) - 3(iii))	1,40,000
	ii. Total (₹ Lakhs) (1 × 4(i))	1260.00
	iii. Profit Volume Ratio (%)	20.00

Serial	Particulars	Data
	Fixed Costs (₹ Lakhs)	882.00
	Profit (₹ Lakhs) (4(ii) - 5)	378.00

It may be observed from the analysis that 'Model T' generates a contribution of ₹ 1,40,000 per piece and ₹1260 lakhs per month. After deducting Fixed Costs of ₹ 882.00 lakhs, ABL is left with a profit of ₹ 378 lakhs. The variable costs work out to 80% and the PV ratio computes to 20%. The contribution margin concept can be applied throughout a business, for individual products, product lines, profit centers, subsidiaries, distribution channels, sales by customer, and for an entire business.

Break Even Analysis

Another important offshoot of marginal costing is break even analysis. It enables the enterprise to determine with better accuracy whether a product is a profitable one or not. Best of all, the analysis can be applied to evaluate every product or service that is on offer. In simple terms, break-even analysis is a simple way to determine how much of the product must be sold to generate a specific level of profitability.

Break Even Point (BEP) signifies the level of activity at which there is neither profit nor loss. It is the point where 'Total Revenues' equals 'Total Costs'. It is also the level of activity where Contribution equals the Fixed costs. Impliedly, BEP also signifies that Contribution is just sufficient to meet the Fixed Costs. Performance above the breakeven level reflects profit. Sales above the breakeven level reflect the Margin of Safety. Performance below the breakeven level reflects loss. BEP Sales in value can be ascertained by dividing the Fixed Costs with PV Ratio. Taking forward the illustration introduced in the preceding paragraphs, the BEP Sales of 'Model T' can be calculated as demonstrated in the following table followed by a graph:

ABL: BEP Analysis of 'Model T' for the month of

Serial	Particulars	Data
1	Sales (₹ Lakhs)	6300.00
2	Contribution (₹ Lakhs)	1260.00
3	Profit Volume Ratio (%)	20.00
4	Fixed Costs (₹ Lakhs)	882.00
5	BEP Sales (₹ Lakhs) (4/3)	4410.00
6	BEP Sales (Number/units) (4410.00 lakhs / 7.00 lakhs)	630.00

The workings in the table show that ABL breaks even at a sale level of ₹ 4,410 lakhs. The BEP Sales computes to 630 in numbers and works out to 70.00% ($(630/900) \times 100$) of the total sales. At this level, a contribution of ₹ 882.00 lakhs ($630 \times 1,40,000$) is generated which is equivalent of the Fixed Costs. Fixed costs having already been covered by the breakeven sales, the contribution accruing from margin of safety equals to the profit which in the instant case works out ₹ 378 lakhs being 20% of ₹1890 lakhs (i.e., $6,300 \times 4,410$). A higher margin of safety indicates better financial strength whereas a lower margin of safety throws up financial concerns.

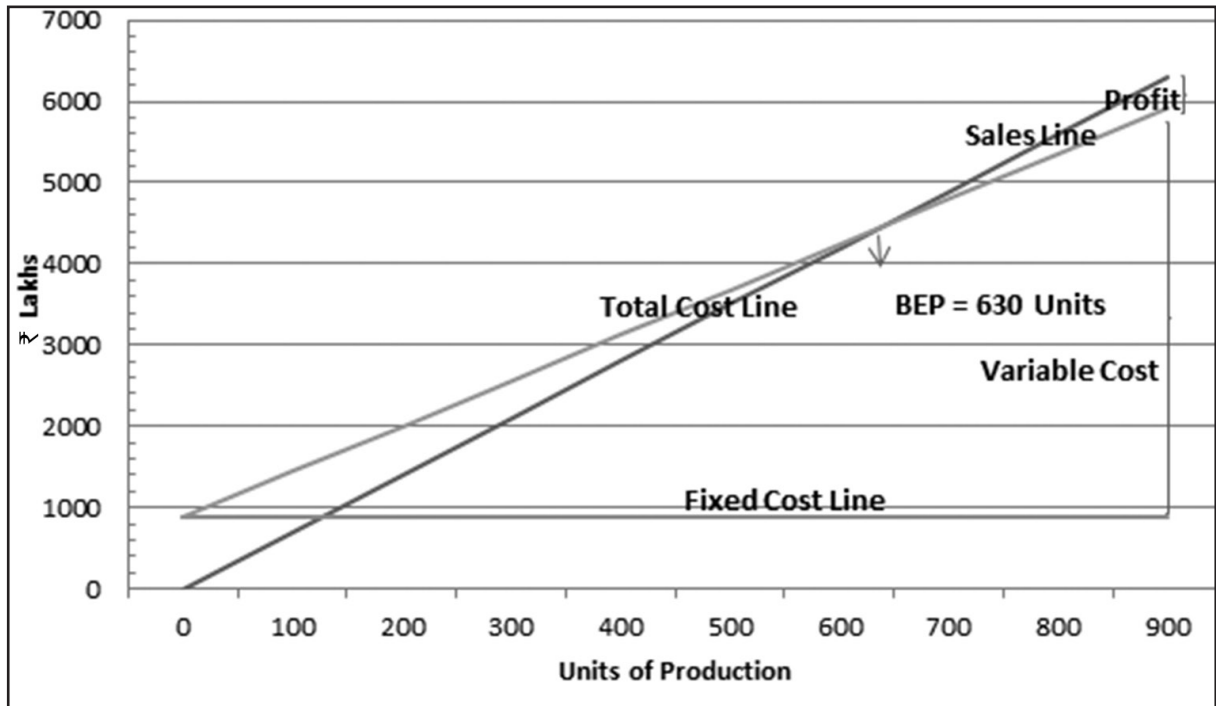


Figure 3.2: ABL: Break Even Graph of 'Model T'

We, thus, derive:

Break Even Point = Fixed Costs ÷ Profit Volume Ratio

Margin of Safety = Total Sales – Breakeven Sales

Profit = Margin of Safety × Profit Volume Ratio

Break-even pricing is a pricing methodology in which the price is set at a point where the product will earn zero profit. Break-even pricing is a common tool used by many an organisation to set the pricing strategy of their portfolio of products. The methodology helps the entity in setting up the lowest acceptable price. The main motive, in such instances, would be to increase the market share rather than earning profits. Numerous managerial decisions can be taken with the help of marginal costing, some of which are discussed in the following paragraphs.

Profit Planning

Contribution analysis is quite helpful in determining the profit targets and sales levels. Assuming that ABL intends to achieve a profit target of ₹400 lakhs for 'Model T' as against the existing amount of ₹378 lakhs, the relevant computations will move as tabulated below:

ABL: Profit Plan of 'Model T'

Serial	Particulars	Formula / Workings	Result
1	Profit Target (₹ Lakhs)	Intention	400.00
2	Contribution Target (₹ in lakhs)	(Fixed Costs + Target Profit) = 882.00 + 400.00	1282.00

Serial	Particulars	Formula / Workings	Result
3	Sales Target (₹ Lakhs)	(Contribution ÷ PV Ratio) = 1282.00 ÷ 20%	6410.00
4	Sales Target (Number/units)	(Sales in Lakhs ÷ Sale Price) = 64,10,00,000 ÷ 7,00,000	915.71 i.e., say 916 units

At a production level of 916 units, the additional sixteen units will bring in an additional contribution of ₹22.40 lakhs (i.e., 16 units × ₹1,40,000 per unit) and push up the profit from the existing amount of ₹378.00 lakhs to the intended level of ₹400.40 lakhs.

Key Factor Analysis

Key Factor Analysis enables allocation of the available resources towards achieving maximum contribution and thereby maximum profits. When there is any limitation in relation to any of the input factors, the choice can be made by ascertaining the contribution per unit of that factor of production which is limited in the given situation. Such a factor of production which is limited in the question is called Key Factor or Limiting Factor. The limiting factors could be any of the critical input resources such as scarce raw materials, skilled labour hours, or special machine hours, and so on. In such an eventuality, the input resources can be allocated amongst the competing products on the basis of contribution per unit of the input. The product with the highest contribution is given the first preference followed by others in a similar suit.

Impact Analysis

The technique of Marginal Costing facilitates analysis of the impact on profits of various changes in production and cost factors. In the event that ABL can increase or decrease its production by 50 units of 'Model T', the impact analysis would run as follows.

ABL: Impact Analysis for Different Levels of Production of 'Model T'

Sl.	Particulars	Existing Level	Increased Level	Decreased Level
1	Number of Units	900	950	850
2	Sales @ ₹7,00,000 per unit (₹ Lakhs)	6300.00	6650.00	5950.00
3	Contribution @ 20% PV Ratio	1260.00	1330.00	1190.00
4	Fixed Costs (₹ Lakhs)	882.00	882.00	882.00
5	Profit (₹ Lakhs)	378.00	448.00	308.00
6	Profitability (%)	6.00	6.74	5.18
7	Impact on Profit (₹ Lakhs) Variation from Existing Level		70.00	(70.00)
8	Impact on Profitability (% Points) Variation from Existing Level		0.74	(0.82)

The computations in the table are self-explanatory. The increase in production by 50 (950 - 900) units will add up ₹70 lakhs to the profits whereas the decrease by 50 (900 - 850) units will reduce the profits by the same amount.

However, in case of reduction the impact on profitability is higher viz. 0.82 percentage points as against 0.74 percentage points for the increase. Similar impact analysis can be carried out for any changes in relation to Sale Price, Variable Costs, and other relevant factors.

Evaluation of Alternatives

Contribution Analysis is helpful in determination of profitability of the products as also choosing between the competing products. In a situation where ABL has a choice of using its enhanced level of capacity either for producing 50 units of 'Model T' or 50 units of another model called 'Model P', the evaluation can be carried out as under.

ABL: Evaluation of 'Model T' versus 'Model P'

Serial	Particulars	Model T	Model P
1	Number of Tractors	50	50
2	Selling Price (₹ / Piece)	7,00,000	8,00,000
3	Variable Costs (₹ Per Piece)	5,60,000	6,40,000
4	Contribution		
	i. ₹ Per Piece (2-3)	1,40,000	1,60,000
	ii. Total (₹ Lakhs) (1 × 4(i))	70.00	80.00
5	Differential Contribution (₹ Lakhs)		10.00
6	Preferred Choice		Model P

Between the two products, 'Model T' and 'Model P', per unit contribution of 'Model P' is higher at ₹1,60,000 in comparison to the per unit contribution of ₹1,40,000 of 'Model T'. Hence the obvious choice, for utilising the enhanced capacity, falls on 'Model P' whereby differential contribution of ₹10 lakhs is generated in comparison.

The evaluation can extend to many other decisions such as Make or Buy, Accept or Reject an order, Determination of selling price in different conditions, Replace one product with some other product, Shutdown or Continue and so on. The illustrative examples that follow, reflect the real time situations at the ground level and are symbolical to case studies.

Illustration 1 (Computation of BEP & Profit Planning)

The income statement of Ashok Gears Ltd. is summarized as below:

Net Revenue	₹ 80,00,000
Less: Expenses (including ₹40,00,000 of Fixed Cost)	₹ 88,00,000
Net Loss.....	₹ 8,00,000

The manager believes that an increase of ₹20,00,000 as fixed expenditure in advertising outlays will increase the sales substantially. His plan was approved by the Board.

You are required to calculate:

- At what sales volume will the Company have break even?
- What sales volume will result in a Net Profit of ₹ 4,00,000?

Solution:

(i) Computation of Break-Even Sales

Net Revenue	= ₹ 80,00,000	
Variable Expenses	= ₹ (88,00,000 - 40,00,000)	= ₹ 48,00,000
Contribution	= (80,00,000 – 48,00,000)	= ₹ 32,00,000
Contribution Margin Ratio (PV Ratio)	= 32,00,000 ÷ 80,00,000	= 40%
Revised Fixed Cost	= (Existing 40,00,000 +20,00,000 of Advertising)	= ₹ 60,00,000
Break Even Sales	= (Fixed Cost ÷ PV Ratio)	= (60,00,000 ÷ 40%) = ₹ 1,50,00,000

(ii) Computation of sales level to earn a Net Profit of ₹ 4,00,000

Targeted Contribution	= (Fixed Cost + Desired Profit)	= (60,00,000 + 4,00,000)
		= ₹ 64,00,000
Required Sales	= (Targeted Contribution ÷ PV Ratio)	= (64,00,000 ÷ 40%) = ₹ 1,60,00,000

(Explanatory Comment: The problem brings forth the primary application of marginal costing in manufacturing sector for the purposes of calculating the BEP and profit planning.)

Illustration 2 (Accept or Reject)

A manufacturing company currently operating at 80% capacity has received an export order from Middle East, which will utilise 40% of the capacity of the factory. The order has to be either taken in full and executed at 10% below the current domestic prices or rejected totally. The current sales and cost data are given below:

Sales	₹ 16.00 lakhs
Direct Material	₹ 5.80 lakhs
Direct Labour	₹ 2.40 lakhs
Variable Overheads	₹ 0.60 lakhs
Fixed Overheads	₹ 5.20 lakhs

The following alternatives are available to the management:

- Continue with domestic sales and reject the export order.
- Accept the export order and allow the domestic market to starve to the extent of excess of demand.
- Increase capacity so as to accept the export order and maintain the domestic demand by:
 - Purchasing additional plant and increasing 10% capacity and thereby increasing fixed overheads by ₹ 65,000, and
 - Working overtime at one and half time the normal rate to meet balance of the required capacity.

Required: Evaluate each of the above alternatives and suggest the best one.

Solution:

Alternative (A): Continue with domestic sales and reject the export order.

Serial	Description	Workings	₹ Lakhs
1	Capacity	Given – 80%	
2	Sales	Given	16.00
3	Variable Costs	Given	
	a. Direct Material		5.80
	b. Direct Labour		2.40
	c. Variable Overheads		0.60
	d. Sub Total		8.80
4	Contribution	(2 - 3)	7.20
5	Fixed Costs	Given	5.20
6	Profit	(4 – 5)	2.00

Alternative (B): Accept the export order and allow the domestic market to starve to the extent of excess of demand

This alternative envisages utilization of 40% of the capacity for the export order and 60% of the capacity for domestic market. Further, the export order is to be executed at 10% below the current domestic prices i.e., $(100 - 10)\% = 90\%$ of the price. Accordingly:

$$\text{Sales at 100\% Capacity} = (16 \div 80\%) = ₹20 \text{ Lakhs}$$

$$\text{Value of the export order} = (40\% \text{ of Capacity} \times 90\% \text{ of the Price}) = (20 \times 40\% \times 90\%) = ₹ 7.20 \text{ lakhs.}$$

$$\text{Value of the domestic sales} = (20 \times 60\%) = ₹ 12.00 \text{ lakhs.}$$

Serial	Description	Workings	₹ Lakhs
1	Capacity	Export 40% + Domestic 60%	
2	Sales	7.20 + 12.00	19.20
3	Variable Costs		
	a. Direct Material	$(5.80 / 80\%) \times 100\%$	7.25
	b. Direct Labour	$(2.40 / 80\%) \times 100\%$	3.00
	c. Variable Overheads	$(0.60 / 80\%) \times 100\%$	0.75
	d. Sub Total		11.00
4	Contribution	(2 - 3)	8.20
5	Fixed Costs	Given	5.20
6	Profit	(4 – 5)	3.00

Alternative (C): Increase capacity so as to accept the export order and maintain the domestic demand by:

- (i) Purchasing additional plant and increasing 10% capacity and thereby increasing fixed overheads by ₹ 65,000, and

(ii) Working overtime at one and half time the normal rate to meet balance of the required capacity.

Serial	Description	Workings	₹ Lakhs
1	Capacity	Export 40% + Domestic 80%	
2	Sales	7.20 + 16.00	23.20
3	Variable Costs		
	a. Direct Material	$(5.80 / 80\%) \times 120\%$	8.70
	b. Direct Labour	$(2.40 / 80\%) \times 120\%$	3.60
	c. Variable Overheads	$(0.60 / 80\%) \times 120\%$	0.90
	d. Overtime Premium [Balance capacity of 10%]	$(2.40 / 80\%) \times 10\% \times 50\%$	0.15
	e. Sub Total		13.35
4	Contribution	(2 - 3)	9.85
5	Fixed Costs [Including fixed O/H for capacity increased of 10 %]	(5.20 + 0.65)	5.85
6	Profit	(4 - 5)	4.00

Suggestion: Alternative (C) with the highest profit of ₹4.00 lakhs works out to be the best.

(Explanatory Comment: The problem is a good example to understand the methodology for evaluation of various alternatives with the help of marginal costing.)

Illustration 3 (Limiting Factor Analysis & Optimum Mix)

A manufacturer has three products A, B, and C. Current sales, cost and selling price details and processing time requirements are as follows:

	Product A	Product B	Product C
Annual sales (units)	6000	6000	750
Selling Price (₹)	20	31	39
Unit Cost (₹)	18	24	30
Processing time required per unit (hour)	1	1	2

The firm is working at full capacity (13,500 processing hours per year). Fixed manufacturing overheads are absorbed into unit costs by a charge of 200% of variable costs. This procedure fully absorbs the fixed manufacturing overhead.

Assuming that:

- Processing time can be switched from one product line to another.
- The demand at current selling price (₹) is:

Product A	Product B	Product C
11,000	8,000	2,000

- The selling prices are not be altered.

You are required to calculate the best production programme for the next operating period and to indicate the increase in net profit that this programme should yield. In addition, identify the shadow price of processing hour.

Solution:

Computation of Contribution per Labour Hour & Preference:

Serial	Description		A	B	C
1	Selling price	₹	20	31	39
2	Unit Cost	₹	18	24	30
3	Variable cost (1/3 rd of Unit Cost)	₹	6	8	10
4	Contribution per unit (1 – 3)	₹	14	23	29
5	Processing hours per unit		1	1	2
6	Contribution per hour (4 ÷ 5)	₹	14	23	14.50
7	Preference		III	I	II

Computation of Current Profit:

Serial	Description		A	B	C	TOTAL
1	No of units		6,000	6,000	750	
2	Contribution per unit	₹	14	23	29	
3	Total contribution	₹	84,000	1,38,000	21,750	2,43,750
4	Fixed cost per Unit (2/3 rd s of Unit Cost)	₹	12	16	20	
5	Total Fixed cost	₹	72,000	96,000	15,000	1,83,000
6	Profit (3-5)	₹				60,750

Statement showing Optimum Mix & Profit at that Mix:

Serial	Description		A	B	C	Total
1	Order of Preference		III	I	II	
2	Process hours per unit		1	1	2	
3	Demand (Units)		11,000	8,000	2,000	
4	Hours Needed (2 × 3)		11,000	8,000	4,000	23,000
5	Hours Allocated		1,500	8,000	4,000	13,500
6	No of units		1,500	8,000	2,000	
7	Contribution per unit	₹	14	23	29	
8	Total contribution	₹	21,000	1,84,000	58,000	2,63,000
9	Fixed cost	₹				1,83,000
10	Profit	₹				80,000

Increase in Profit = (80,000 - 60,750) = ₹ 19,250

Shadow Price: Shadow price is the opportunity cost of one unit of resource relevant for the decision maker. In the present case every extra processing hour will increase the production of A by one unit and the contribution by ₹ 14. Therefore, the shadow price of processing hour is ₹ 14.

Working Note for allocation of Hours

Total Hours Available	=	13,500	
Hours for B	=	8000×1	= 8,000
Hours Available for C & A	=	$(13,500 - 8,000)$	= 5,500
Hours for C	=	$2,000 \times 2$	= 4,000
Hours Available for A	=	$(5,500 - 4,000)$	= 1,500

(Commentary: The problem serves as a good example for understanding the Limiting Factor Analysis and Optimum Product Mix.)

Illustration 4 (Optimum Product Mix & Maximisation of Profit, Multiple limiting factors / constraints)

As a part of its rural upliftment programme, the Government has put under cultivation a farm of 96 hectares to grow tomatoes of four varieties: Royal Red, Golden Yellow, Juicy Crimson and Sunny Scarlet. Of the total 96 hectares, 68 hectares are suitable for all four varieties, but the remaining 28 hectares are suitable for growing only Golden Yellow and Juicy Crimson. Labour is available for all kinds of farm work and there is no constraint. The market requirement is that all four varieties of tomatoes must be produced with a minimum of 1,000 boxes of any one variety. The farmers engaged have decided that the area devoted to any crop should be in terms of complete hectares and not in fractions of a hectare. The other limitation is that not more than 22,750 boxes of any one variety should be produced. The following data are given.

Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
Annual Yield (Boxes per hectare)	350	100	70	180
Direct Material Costs (₹ per hectare)	4,760	2,160	1,960	3,120
Labour Costs (₹)				
a. Growing per hectare	8,960	6,080	3,710	5,280
b. Harvesting & packing per box	36	32	44	52
c. Transportation per box	52	52	40	96
Market price per box	153.80	158.70	183.80	222.70

Fixed Overheads per annum

Growing	₹ 1,12,000
Harvesting	₹ 74,000
Transportation	₹ 72,000
General Administration	₹ 1,02,000

Required

- (i) Product Preference within the given constraints
- (ii) Optimum Product Mix & Maximum Profit

- (iii) A nationalized bank has come forward to help in an improvement programme for the piece of 28 hectares in which only Golden Yellow and Juicy Crimson used to grow, with a loan of ₹50,000 at a very nominal interest of 6% per annum. After this improvement is carried out, there will be a saving of ₹12.50 per box in the harvesting cost of Golden Yellow and the 28 hectares will become suitable for growing Royal Red in addition to the existing Golden Yellow and Juicy Crimson varieties. Assuming that other constraints continue, find the maximum total profit that would be achieved after the improvement programme is carried out.

Explanatory Comments

While seeking solutions in terms of product preference, optimum product mix, maximum profit and evaluation of alternatives, the problem sets certain constraints. The constraints are:

- (i) 68 hectares are suitable for all four varieties, but the remaining 28 hectares are suitable for growing only Golden Yellow and Juicy Crimson
- (ii) All four varieties of tomato must be produced with a minimum of 1,000 boxes of any one variety
- (iii) The area devoted to any crop should be in terms of complete hectares
- (iv) Not more than 22,750 boxes of any one variety should be produced
- (v) After an improvement is carried out the 28 hectares will become suitable for growing Royal Red in addition to the existing Golden Yellow and Juicy Crimson varieties

The problem can be solved by adopting five steps:

- (i) Determination of Contribution per hectare & product preference
- (ii) Computation of Optimum Product Mix
- (iii) Computation of Maximum Profit
- (iv) Computation of Optimum Mix after the improvement programme
- (v) Computation of Profit after the improvement programme

Here follows the stepwise solution. In order to assimilate the concepts, the students are advised to go through the notes, furnished at relevant places, carefully.

Solution:

Step 1: Determination of Contribution per hectare & product preference

Amount (₹)

Serial	Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
1	Sales per hectare				
	a. Boxes per hectare	350	100	70	180
	b. Market / Sales Price per Box	153.80	158.70	183.80	222.70
	c. Sales (a × b)	53,830	15,870	12,866	40,086
2	Variable costs				
	a. Direct material	4,760	2,160	1,960	3,120
	b. Growing cost	8,960	6,080	3,710	5,280

Serial	Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
	c. Harvesting and packing				
	Per Box	36	32	44	52
	Per hectore	12,600	3,200	3,080	9,360
	d. Transport				
	Per Box	52	52	40	96
	Per hectore	18,200	5,200	2,800	17,280
	e. Total Variable Cost	44,520	16,640	11,550	35,040
3	Contribution per hectore (1 – 2)	9,310	-770	1,316	5,046
4	Rank / Order of Preference	I	IV	III	II

Note: Order of preference is decided on the basis of contribution per hectore

Step 2: Computation of Optimum Product Mix

Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
(a) Minimum Boxes Requirement	1,000	1,000	1,000	1,000	
(b) Annual Yield of Boxes / Hectore	350	100	70	180	
	2.85		14.28	5.55	
Required Minimum Area (Hectores) [a ÷ b]	i.e., 3.00 Note (i)	10.00	i.e., 15.00 Note (ii)	i.e., 6.00 Note (iii)	34.00
Balance Area (96 – 34) (Hectores)					62.00
Maximum area for 22,750 boxes (Hectores) (22750 / Annual yield of Boxes)	65 $= \frac{22,750}{350}$	227.50 $= \frac{22,750}{100}$	325 $= \frac{22,750}{70}$	126.39 $= \frac{22,750}{180}$	
Allocation of area 68 hectores suitable for all varieties being distributed for preferences 1 and 2	62.00			6.00	
28 hectores suitable for Golden yellow & Juicy Crimson		10.00	18.00		
Total	62.00	10.00	18.00	6.00	96.00

Notes:

- In case of Royal Red, the minimum area of 2.85 hectores has been rounded off to the next higher multiple 3.
- In case of Juicy Crimson, the minimum area of 14.28 hectores has been rounded off to the next higher multiple 15.
- In case of Sunny Scarlet, the minimum area of 5.55 hectores has been rounded off to the next higher multiple 6.

Strategic Cost Management

- (iv) Of the 68 hectares suitable for all varieties, 62 acres have been apportioned to Royal Red after allocating the minimum area of 6 to Sunny Scarlet.
- (v) Of the 28 hectares suitable for Golden yellow & Juicy Crimson, 18 acres have been apportioned to Juicy Crimson after allocating the minimum area of 10 to Golden yellow.

Step 3: Computation of Maximum Profit

(Amount in ₹)

Serial	Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
1	Area (Hectors)	62	10	18	6	96
2	Contribution per hecter	9310	(770)	1316	5046	
3	Total contribution	5,77,220	(7,700)	23,688	30,276	6,23,484
4	Fixed costs					
	a. Growing					1,12,000
	b. Harvesting					74,000
	c. Transport					72,000
	d. General Administration					1,02,000
	e. Sub Total (a + b + c + d)					3,60,000
5	Profit (3-4)					2,63,484

Step 4: Computation of Optimum Mix & Profit after the improvement programme

Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
Minimum Area (hectares)	3.00	10.00	15.00	6.00	34.00
Balance area being apportioned on the basis of product preference	62.00				62.00
Total area (hectares)	65.00	10.00	15.00	6.00	96.00

Note: Product-wise apportionment of the area has been done by following a similar process as has been outlined in step2.

Step 5: Computation of Profit after the improvement programme

(Amount in ₹)

Serial	Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
1	Area (Hectors)	65	10	15	6	96
2	Contribution per hecter Existing	9310	(770)	1316	5046	
	Savings after the improvement		1250			
	Revised	9310	480	1316	5046	
3	Total contribution	6,05,150	4,800	19,740	30,276	6,59,966

Serial	Particulars	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
4	Fixed costs					
	a. Growing					1,12,000
	b. Harvesting					74,000
	c. Transport					72,000
	d. General Administration					1,02,000
	e. Interest @ 6% on ₹ 50,000/-					3,000
	f. Sub Total (a..d)					3,63,000
5	Profit					2,96,966

(Commentary: Be it be manufacturing sector, service sector or agriculture sector, the application of Marginal Costing is Universal.)

Illustration 5 (Profit Planning)

MN Agarwal owns a Gift-Shop, a Restaurant and a Lodge in Shillong. Typically, he operates these only during the season period of 4 months in a year. For the past season the occupancy rate in the Lodge was 90% and level of activity in case of Gift-Shop and Restaurant was 80%. The relevant data for the past season were as under-

(Amounts in ₹)

	Gift-Shop		Restaurant		Lodge	
	Amount (₹)	%	Amount (₹)	%	Amount (₹)	%
1. Receipts/ Sales	48,000	100	64,000	100	1,80,000	100
2. Expenditure:						
Cost of Sales	26,400	55	35,200	55	-	-
Supplies	2,400	5	6,400	10	14,400	8
Insurance & Taxes	1,920	4	6,400	10	36,000	20
Depreciation	2,880	6	8,000	12.50	39,600	22
Salaries	4,800	10	4,800	7.50	25,200	14
Electricity Charges	960	2	3,200	5	13,500	7.50
Total	39,360	82	64,000	100	1,28,700	71.50
3. Profit	8,640	18	-	-	51,300	28.50

Additional information:

- Cost of Sales and Supplies vary directly with the occupancy rate in case of Lodge and level of activity in case of Gift Shop and Restaurant.
- Insurances and Taxes and Depreciation are for the entire period of twelve months.
- Salaries paid are for the season period except a Chowkidar for the Lodge who is paid for the full year at ₹400 per month.
- Electricity Charges include Fixed Charges of ₹640, ₹1,920 and ₹9,900 for Gift-shop, Restaurant and Lodge respectively.

The balance amount varies directly with occupancy rate in case of Lodge and level of activity in case of Gift-Shop and Restaurant. Fixed Electric Charges are for the season except in case of Lodge where ₹6,900 is for the season and ₹3,000 for the entire period of twelve months.

Mr. Agarwal is interested in increasing his Net Income. The following options are under consideration -

- To continue the operations during the season period only by inserting advertisement in newspapers thereby occupancy rate to reach 100% in case of Lodge and 90% level of activity in respect of Gift-Shop and Restaurant. The costs of advertisement are estimated at ₹12,000.
- To continue operations throughout the entire period of twelve months comprising season period of four months and off-season period of eight months. The occupancy rate is expected at 90% and 40% during season period and off-season period respectively in case of the Lodge. The room rents are bound to be reduced to 50% of the original rates during off-season period. The level of activity of Gift-Shop and Restaurant is expected at 80% and 30% during season and off-season period respectively but 5% discount on the original rates will have to be offered during off-season period.

Which option is profitable? As a Cost Accountant would you like to suggest him any other alternative based upon the above figures, which can be adopted to earn more net profit? (Use Incremental Revenue and Cost Approach.)

Solution:

(a) Option 1: Operate during Season only

Incremental Revenues and Costs in ₹

Particulars	Gift- Shop	Restaurant	Lodge	Total
Incremental Revenue	Given ₹ 48,000 at 80%, Addl. Revenue for extra 10% = 48,000 × (10/80) = 6,000 Extra 10% = (90-80)%	Given ₹ 64,000 at 80%, Addl. Revenue for extra 10% = 64,000 × (10/80) = 8,000 Extra 10% = (90-80)%	Given ₹ 1,80,000 at 90%, Addl. Revenue for extra 10% = 180,000 × (10/90) = 20,000 Extra 10% = (90-80)%	34,000
Incremental Costs				
Cost of Sales	6,000 × 55% = 3,300	8,000 × 55% = 4,400	Nil	7,700
Supplies	6,000 × 5% = 300	8,000 × 10% = 800	20,000 × 8% = 1,600	2,700
Electricity Charges (Excluding Fixed Charges)	(960 - 640) × (10/80) = 40	(3,200 - 1,920) × (10/80) = 160	(13,500 - 9,900) × (10/90) = 400	600
Advertisement				12,000
Total of Incremental Costs				23,000
Incremental Profit				11,000

(b) Option 2: Operate during all 12 months

Incremental Revenues and Costs in ₹

Particulars	Gift- Shop	Restaurant	Lodge	Total
Incremental Revenue	48,000 × 2 × (30% / 80%) × 95% = 34,200	64,000 × 2 × (30% / 80%) × 95% = 45,600	1,80,000 × 2 × (40% / 90%) × 50% = 80,000	1,59,800

Particulars	Gift- Shop	Restaurant	Lodge	Total
Incremental Costs				
Cost of Sales	$34200 \times 55\% = 18810$	$45600 \times 55\% = 25080$	Nil	43,890
Supplies	$34200 \times 5\% = 1710$	$45600 \times 10\% = 4560$	$80,000 \times 8\% = 6,400$	12,670
Salaries	$4800 \times 2 = 9600$	$4800 \times 2 = 9600$	$25200 - (400 \times 12) \times 2 = 40,800$	60,000
Electricity Charges – Fixed	$640 \times 2 = 1,280$	$1,920 \times 2 = 3,840$	$6,900 \times 2 = 13,800$	18,920
Electricity Charges - Variable	$(960 - 640) \times 2 \times (30\%/80\%) = 240$	$(3,200 - 1,920) \times 2 \times (30\%/80\%) = 960$	$(13500 - 9900) \times 2 \times (40\%/90\%) = 3,200$	4,400
Total of Incremental Costs				1,39,880
Incremental Profit				19,920

Suggestion

Both options are desirable since there is an Incremental Net Income. Option 2 is better than Option 1 by ₹120. However, it is suggested that the Firm should adopt a combination of both options in which case, the Total Additional Profit will be ₹11,000 + ₹10,880 = ₹21,880.

Illustration 6 (Make or Buy)

S.H.Ltd., a cycle manufacturing company, has drawn up a programme for the manufacture of a new product for the purpose of fuller utilization of its capacity. The scheme envisages the manufacture of baby tricycle fitted with a bell. The company estimates the sales of tricycles at 10,000 during the first year and expects that from the second year onwards the sales estimates will stabilize at 20,000 tricycles. Since the company has no provision for the manufacture of the small bells specially required for the tricycles, the requirement of the bells is initially proposed to be met by way of purchase from the market at ₹8 each. However, if the company desires to manufacture the bell in its factory by installation of new equipment, it has two alternative proposals as under:-

	Installation of Super X Machine	Installation of Janta Machine
Initial Cost of Machine	₹ 3.00 Lakhs	₹ 2.00 Lakhs
Life	10 Years	10 Years
Fixed Overheads p.a. other than depreciation	₹ 54,000	₹ 28,000
Variable expenses per unit	₹ 4.00	₹ 5.00

Required:

- For each of the two levels of output namely 10,000 and 20,000 bells state with suitable workings whether the company should purchase the bells from market or install new equipment for manufacture of bells. If your decision is in favour of the installation of new equipment, which of the two new machines should be installed?
- What would be your decision in case the forecast of requirement from the second year onwards is estimated at 40,000 bells instead of 20,000 bells?
- At what volume of bells will the installation of the two machines break even.

Solution:

a. Cost-Benefit Analysis of two machines at Output Level of 10,000 and 20,000 units

Output	10000 units		20000 Units	
	Super X	Janta	Super X	Janta
Details				
Cost of buying @ ₹ 8	80,000	80,000	1,60,000	1,60,000
Cost of Manufacturing				
Variable cost	40,000	50,000	80,000	1,00,000
Depreciation on Machine	30,000	20,000	30,000	20,000
Super X = $\left(\frac{3,00,000}{10 \text{ years}}\right)$ Janta = $\left(\frac{2,00,000}{10 \text{ years}}\right)$				
Fixed overheads	54,000	28,000	54,000	28,000
Total cost	1,24,000	98,000	1,64,000	1,48,000
Decision (Cost of Buying or Cost of M/g Whichever is lower)	Buy from Market (Super X or Janta)		Install Janta Machine	

b. Buy / manufacture decision at level of 40,000 units in the Second year

	Super X	Janta
Cost of Buying @ ₹ 8	3,20,000	3,20,000
Cost of Manufacturing		
Variable Cost	1,60,000	2,00,000
Depreciation on Machine	30,000	20,000
Fixed Overheads	54,000	28,000
Total Cost	2,44,000	2,48,000
Cost Saving on Manufacture	76,000	72,000

Decision – As Super X machine gives better saving, it should be installed at an estimated volume of 40000 units

c. Break – even volume of installation of X two machines: It is that volume of production at which a manufacturer is indifferent as to which machine he should install as total cost on both machine is the same. This point is known as cost indifference point.

Let Break-even volume = x units

Cost on super-X Machine for x units = 54,000 + 30,000 + 4x = 84,000 + 4x ... (1)

Cost on Janata Machine for x units = 20,000 + 28,000 + 5x = 48,000 + 5x ... (2)

At cost indifference point total cost under two alternatives will be equal.

Therefore,

$$84,000 + 4x = 48,000 + 5x \quad \text{or} \quad x = 36,000 \text{ units.}$$

So, at 36,000 units the installation of the two machines will break even.

Illustration 7 (Make or Buy & Evaluation of Alternatives)

Household Equipments Ltd. is producing kitchen equipment from five components three of which are made using general purpose machines and two by manual labour. The data for the manufacture of the equipment is as follows:

Components	A	B	C	D	E	Total
Machines hours reqd. per unit	10	14	12			36 hrs
Labour hours reqd. per unit				2	1	3hrs
Variable cost per unit (in ₹)	32	54	58	12	4	160
Fixed cost per unit (apportioned) ₹	48	102	106	24	36	316
Total component cost ₹	80	156	176	36	30	478
Assembly cost/unit (all variable)						₹ 40
Selling price/unit						₹ 600

The marketing department of the company anticipates 50% increase in demand during the next period. General purpose machinery used to manufacture. A, B and C is already working to the maximum capacity of 4752 hours and there is no possibility of increasing this capacity during the next period. But labour is available for making components D and E and also for assembly according to demand. The management is considering the purchase of one of the components A, B or C from the market to meet the increase in demand. These components are available in the market at the following prices: Components A: ₹ 80, Components B: ₹ 160, Components C: ₹ 125

Required:

- Profit made by the company from current operations.
- If the company buys any one of the components A, B or C, what is the extent of additional capacity that can be created?
- Assuming 50% increase in demand during the next period, which components A, B or C should the company buy from the market?
- The increase in profit, if any, if the component suggested in (c) is purchased from the market.

Solution:

(a) Statement showing profit at current operations

		Amount (₹)
SP		600
Variable Costs	160	
Cost of Assembly	40	
Total		200

		Amount (₹)
Contribution per Unit (SP - VC)		400
No. of units (Maximum hours ÷ Labour Hours per unit)	4752 ÷ 36	132 Units
Total Contribution (Cont./unit × No. of units)	(400 × 132)	52,800
Fixed Cost	(132 units × ₹ 316 p.u.)	41,712
Profit		11,088

(b) Computation of additional capacity created if components are bought from outside:

(i) If A is bought

Capacity released	= 10 hours × 132 units	= 1320 hours
Machine hours needed per unit of B & C	= 14 + 12	= 26 hours
Additional units that can be manufactured	= 1320 ÷ 26	= 50.77
Increase in Capacity	= (50.77 ÷ 132) × 100	= 38.46%

(ii) If B is bought

Capacity released	= 14 hours × 132 units	= 1848 hours
Machine hours needed per unit of B & C	= 10 + 12	= 22 hours
Additional units that can be manufactured	= 1848 ÷ 22	= 84
Increase in Capacity	= (84 ÷ 132) × 100	= 63.64%

(iii) If C is bought

Capacity released	= 12 hours × 132 units	= 1584 hours
Machine hours needed per unit of B & C	= 10 + 14	= 24 hours
Additional units that can be manufactured	= 1584 ÷ 24	= 66
Increase in Capacity	= (66 ÷ 132) × 100	= 50.00%

(c) Evaluation as to buy which component assuming 50% increase in demand during the next period**Computation of Preference for Buying**

Amount (₹)

	A	B	C
Buying cost	80	160	125
Variable Cost	32	54	58
Excess buying Cost (Buying Cost – Variable Cost)	48	106	67
Excess buying cost per Machine hour	4.8	7.571	5.583
Ranking Preference for buying	I	III	II

It is better to buy component A from the market because excess buying cost per machine hour is less. But the increase in capacity will be just 38.46% and hence not sufficient to meet the expected demand for next year. Therefore, next preference is buying the next cheaper component. i.e., C whereby the increase in capacity will be exactly equal to the increase in demand of 50% during the next year.

Hence, component 'C' should be bought from the market.

(d) Statement showing computation of profit by buying C from outside:

		Amount (₹)
SP		600
Variable Costs		
Cost of Machining (160* + 67)	227	
Cost of Assembly	40	267
Contribution per Unit		333
No. of units	4752 ÷ 24	198 Units
Total Contribution (Cont. / unit × No. of units)		65,934
Fixed Cost		41,712
Profit (Cont. – FC)		24,222
Existing Profit		11,088
Increase in Profit		13,134

Illustration 8 (Evaluation of Alternatives for Profit Planning)

AB Limited has two divisions Alpha & Beta. Alpha produces components, two units of which are required for one unit of final product produced by Beta. Alpha has a capacity to produce 20,000 units and entire quantity is supplied to Beta @ ₹ 200/unit. Variable cost component at Alpha is ₹ 190 & fixed cost ₹ 20 per unit. For final product of Beta, per unit variable cost excluding component is ₹ 700, fixed cost ₹ 200 and selling price is ₹ 1500. Alpha has placed a proposal for increasing the transfer price to ₹ 220 i.e., the market price. Facility at Alpha can be rented out @ ₹ 3.00 Lakhs p.a. Manager at Alpha wants to opt for this alternative. Beta can buy this component from outside market @ ₹ 210. If capacity of Alpha is augmented to 40,000 units with an additional investment of ₹ 15 lakhs, it can sell 20,000 units to external market and balance to Beta @ ₹ 210 per unit. Fixed cost for Alpha will be up by ₹ 1.00 lakh. Evaluate and give your opinion on:

- Facility of Alpha is rented out and Beta buys from market @ ₹210 per unit
- Alpha sells to outside market @ ₹220 and Beta buys @ 210 per unit from market
- Capacity enhancement at a cost of capital of 12% p.a.

Solution:**(i) Present position on transfer of Alpha @ ₹200 to Beta**

Particulars	Division Alpha	Division Beta
Units sold	20,000	10,000
Selling price per unit (₹)	200	1,500
Variable cost per unit (₹)	190	700 + (2 × 200) = 1,100
Contribution per unit (₹)	10	400
Fixed cost per unit (₹)	20	200

Particulars	Division Alpha	Division Beta
Profit per unit (₹)	(-) 10	200
Total Profit / Loss (₹)	(-)2,00,000	20,00,000

Overall profit for the company = $(-2,00,000 + 20,00,000)$ = ₹ 18,00,000

Total Fixed Cost for Alpha = $(20,000 \times 20)$ = ₹ 4,00,000

Total Fixed Cost for Beta = $(10,000 \times 200)$ = ₹ 20,00,000

(ii) Alternative (a), i.e.. Facility of Alpha is rented out and Beta buys from market @ ₹ 210 per unit

Particulars	Division Alpha	Division Beta
Units sold	0	10,000
Selling price per unit (₹)		1,500
Variable cost per unit (₹)		$700 + (2 \times 210) = 1,120$
Contribution per unit (₹)		380
Total Contribution (₹)		38,00,000
Fixed Cost (₹)		20,00,000
Rental Income (₹)	3,00,000	
Total Profit (₹)	3,00,000	18,00,000

Overall profit for the company = $(3,00,000 + 18,00,000)$ = ₹ 21,00,000

(iii) Alternative (b), i.e.. Alpha sells to outside market @ ₹220 and Beta buys @ 210 per unit from market

Particulars	Division Alpha	Division Beta
Units sold	20000	10000
Selling price per unit (₹)	220	1500
Variable cost per unit (₹)	190	$700 + (2 \times 210) = 1120$
Contribution per unit (₹)	30	380
Total Contribution (₹)	6,00,000	38,00,000
Fixed Cost (₹)	4,00,000	20,00,000
Total Profit (₹)	2,00,000	18,00,000

Overall profit for the company = $(2,00,000 + 18,00,000)$ = ₹ 20,00,000

(iv) Alternative (c), i.e., Capacity enhancement of Alpha at a cost of capital of 12% p.a.

Particulars	Division Alpha (Sale)	Division Alpha (Transfer)	Division Beta
Units sold	20000	20000	10000

Particulars	Division Alpha (Sale)	Division Alpha (Transfer)	Division Beta
Selling price per unit (₹)	220	210	1500
Variable cost per unit (₹)	190	190	700 + (2×210) = 1120
Contribution per unit (₹)	30	20	380
Total Contribution (₹)	6,00,000	4,00,000	38,00,000
Fixed Cost (₹)	4,00,000	1,00,000	20,00,000
Cost of Capital @ 12%		12% of 15,00,000 = 1,80,000	
Total Profit (₹)	2,00,000	1,20,000	18,00,000

Overall profit for the company = (2,00,000 + 1,20,000 + 18,00,000) = ₹ 21,20,000

(v) Evaluation

Serial	Alternative	Overall Profit (₹)
(i)	Present position on transfer of Alpha @ ₹200 to Beta	18,00,000
(ii)	Alternative (a), i.e.. Facility of Alpha is rented out and Beta buys from market @ ₹210 per unit	21,00,000
(iii)	Alternative (b), i.e.. Alpha sells to outside market @ ₹220 and Beta buys @ 210 per unit from market	20,00,000
(iv)	Alternative (c), i.e.. Capacity enhancement of Alpha at a cost of capital of 12% p.a.	21,20,000

Opinion: Since overall profit is the highest, i.e.. ₹ 21,20,000 in alternative 'c', it can be adopted.

Illustration 9 (Optimum Crop Mix & Profit Planning)

An agro-based farm is planning its production for next year. The following is relating to the current year:

Product/Crop	M	N	O	P
Area Occupied (Acres)	125	100	150	125
Yield per acre (ton)	50	40	45	60
Selling Price per ton (₹)	100	125	150	135
Variable Cost per acre (₹)				
Seeds	150	125	225	200
Pesticides	75	100	150	125
Fertilizers	62.50	37.50	50	62.50
Cultivation	62.50	37.50	50	62.50
Direct Wages	2000	2250	2500	2850

Fixed overhead per annum ₹13,44,000. The land that is being used for the production of O and P can be used for either crop. But not for M and N; the land that is being used for the production of M and N can be used for either crop, but not for O and P. In order to provide adequate market service, the company must produce each year at least 1,000 tons of each of M and N and 900 tons each of O and P.

Required:

- Determine the profit for the production mix fulfilling market commitment.
- Assuming the land could be cultivated to produce any of the four products and there was no market commitment, calculate the profit amount of most profitable crop and break-even point of most profitable crop in terms of acres and sales value.

Solution:

(i) Determination of Profit for Production Mix fulfilling the market commitment:

a. Statement of Recommended Product Mix

Sl.	Product	M	N	O	P
1	Yield per acre (ton)	50	40	45	60
2	Selling Price per ton (₹)	100	125	150	135
3	Sales Revenue per acre (₹)	5000	5000	6750	8100
4.	Variable Cost per acre (₹):				
	a. Seeds	150	125	225	200
	b. Pesticides	75	100	150	125
	c. Fertilizers	62.50	37.50	50	62.50
	d. Cultivation	62.50	37.50	50	62.50
	e. Direct Wages	2000	2250	2500	2850
	f. Sub Total (a to e)	2350	2550	2975	3300
5.	Contribution per acre (₹)	2650	2450	3775	4800
6.	Rank	III	IV	II	I
7.	Minimum Sales per annum (tons) (Minimum Market Commitment)	1000	1000	900	900
8.	Minimum Area (acres) [7 ÷ 1]	(1000 ÷ 50) =20	(1000 ÷ 40) = 25	(900 ÷ 45) =20	(900 ÷ 60) =15
9.	Occupied Area (acres)**	125	100	150	125
10.	Recommended Mix as per Rank in 6 (acres)	{(125+100)- 25} = 200	25 (Minimum)	20 (Minimum)	{(150+125) -20} =255

**Area of M&N can be interchanged and area of O&P can be interchanged.

b. Statement of Profit

Serial	Particulars	Workings	Rupees	
1	Contribution for the recommended product Mix	M	(200 × 2650) = 5,30,000	5,30,000
		N	(25 × 2450) = 61,250	61,250
		O	(20 × 3775) = 75,500	75,500
		P	(255 × 4800) = 12,24,000	12,24,000
		Sub Total		18,90,750
2	Fixed Cost		13,44,000	
3	Profit (1-2)		5,46,750	

(ii) Most profitable crop

Product P gives highest contribution of ₹4,800 per acre and hence is the most profitable crop.

Statement of Profit if complete land is used for P:

Contribution = (500 × 4800) = ₹ 24,00,000

Fixed cost = ₹ 13,44,000

Profit = ₹ 10,56,000

Break-even point in acres for P = $13,44,000 \div 4,800 = 280$ acres

Break-even point in sales value = $280 \times 135 \times 60 = ₹ 22,68,000$

(Commentary: The problem reveals the utility of marginal costing with respect to maximisation of crop income, i.e.. agriculture sector.)

Illustration 10 (Continue or Discontinue)

S.G Ltd produces four products in its factory. The volume of production and sales achieved is considerably lower than normal and so there has been substantial under recovery of factory overheads. The sales and cost particulars are as under:

	(₹ In lakhs)				
	Products				Total
	A	B	C	D	
Sales	160	200	80	40	480
Costs:					
Direct Material	24	32	16	3	75
Direct Wages	40	48	32	8	128
Factory Overheads	48	64	40	8	160
Selling & Admn. (15% Sales)	24	30	12	6	72

Total	136	174	100	25	435
Profit / Loss	24	26	(20)	15	45
Under recovery of overheads					24
Profit before tax					21

40% of factory overheads are variable at normal volume and the selling and administration overheads are variable to the extent of 5% of sales. 20% of sales of product C are done in connection with Product A in as much as the discontinuance of Product C will bring down the sale of Product A by 10%. Alternatively, the sale of product C can be reduced to 20% of the present level to maintain the sales of product A.

In view of the loss reported for Product C the management has for consideration three proposals, viz;

- (a) Discontinue product C. In that event the co. can save a sum of ₹8 lakhs p.a. in fixed expenses.
- (b) Maintain the sales of product C to the extent of 20% of the present sales as sales service to product A. In that event the reduction of fixed expenses will be ₹ 3 lakhs p.a.
- (c) Discontinue product C totally and increase the sales of product D for which demand is available to the extent of another ₹40 lakhs. This can be done without any change in fixed expenses.

Present the data to the management bringing out the financial implications of the aforesaid three proposals as compared with the annual operating results generating a profit before tax of ₹21 lakhs. Suggest a course of action to be followed by the S.G Ltd.

Solution:

Step 1: Computation of Variable Factory Overheads & Fixed Factory Overheads

₹ In lakhs

Sl.	Element	A (₹)	B (₹)	C (₹)	D (₹)	Total (₹)
1	Factory Overheads recovered	48.00	64.00	40.00	8.00	160.00
2	(+) under recovery (apportioned in the ratio of 48:64:40:8)	7.20	9.60	6.00	1.20	24.00
3	Overheads at normal value	55.20	73.60	46.00	9.20	184.00
4	Variable Overheads (40% of the total)	22.08	29.44	18.40	3.68	73.60
5	Fixed Overhead (60% of the total)	33.12	44.16	27.60	5.52	110.40

Step 2: Rearranging the data in 'Contribution' format

₹ In lakhs

Sl.	Element	A (₹)	B (₹)	C (₹)	D (₹)	Total (₹)
1	Sales	160.00	200.00	80.00	40.00	480.00
2	Variable Costs					
	Direct Material	24.00	32.00	16.00	3.00	75.00

Sl.	Element	A (₹)	B (₹)	C (₹)	D (₹)	Total (₹)
	Direct Wages	40.00	48.00	32.00	8.00	128.00
	Variable Overheads (Step 1)	22.08	29.44	18.40	3.68	73.60
	Variable Selling & Distribution Overheads (@ 5% of Sales)	8.00	10.00	4.00	2.00	24.00
	Total	94.08	119.44	70.40	16.68	300.60
3	Contribution (% to Sales)	65.92 (41.20)	80.56 (40.28)	9.60 (12.00)	23.32 (58.30)	179.4
4	Fixed Costs					
	Fixed Factory Overheads	33.12	44.16	27.60	5.52	110.40
	Fixed Selling & Distribution Overheads (@ [15% – 5%] of Sales)	16.00	20.00	8.00	4.00	48.00
	Total	49.12	64.16	35.60	9.52	158.40
5	Profit / (Loss) [3 – 4]	16.80	16.40	(26.00)	13.80	21

Step 3: Evaluation of Alternatives**Alternative (a) Computation of Profit if Product C is discontinued**

₹ In lakhs

Sl.	Element	A (₹)	B (₹)	C (₹)	D (₹)	Total (₹)
1	Contribution	59.33 (65.92 – 10% of 65.92)	80.56	-	23.32	163.21
2	Fixed Costs (Reduction by ₹ 8 lakhs)					150.40
3	Profit [158.40 – 8]					12.81

Alternative (b) Computation of Profit if Product C is maintained at 20% level

₹ In lakhs

Sl.	Element	A (₹)	B (₹)	C (₹)	D (₹)	Total (₹)
1	Contribution	65.92	80.56	1.92 (20% × 9.6)	23.32	171.72
2	Fixed Costs [158.40 – 3] (Reduction by ₹ 3 lakhs)					155.40
3	Profit					16.32

Alternative (c) if product C is discontinued totally and the sales of product D is increased to the extent of another ₹ 40 lakhs ₹ In lakhs

Sl.	Element	A (₹)	B (₹)	D (₹)	Total (₹)
1	Contribution	59.33 [65.92 (1-10%)]	80.56	46.64	186.53
2	Fixed Cost				158.40
3	Profit				28.13

Suggested Course of action: From the above computations, it may be observed that profit is more in alternative C i.e., in discontinuing Product C completely & increasing the sales of Product D by 100% (₹ 40 lakhs). Hence, alternative C is suggested.

Illustration 11 (Make or Buy & Choosing between the Alternatives)

T.T.D Ltd., manufacturing a single product, has normal working capacity of 8,000 units per annum. The sales manager has projected a sale of 10,000 units for the year 2023-24 at a price of ₹ 250 per unit. The operating budget for 2023-24 is as under:

	₹ in lakhs	₹ in lakhs
Sales:8,000 units @ ₹ 250 each		20.00
Cost of production		
Raw material	12.00	
Direct wages	3.00	
Works overhead (50% Fixed)	1.40	
Admn. overhead (all fixed)	0.60	
Selling & Distribution O H (80% Fixed)	1.00	18.00
Profit		2.00

In order to increase production to meet the sales demand, two proposals have been put forward as under:

- (1) Sub-contracting the production of 2,000 units at ₹ 225 per unit.
- (2) Installing additional machine which will entail the following expenses:
 - a. Cost of machine ₹ 2,00,000; Life 20 years
 - b. Recruitment of 10 workers including direct workers to operate the machine at a wage rate of ₹ 500 each per month. Add 25% towards fringe benefits. (None of the existing workers will be utilised for this purpose).
 - c. Interest on capital required for the purchase of machine 15% p.a.

The following additional fixed expenses will be required in respect of both alternatives: Administration expenses - ₹ 10,000 per year & Selling & Distribution expenses- ₹ 20,000 per year. You are required to prepare:

1. A statement showing respective profitability of the two methods of increasing the production.
2. Comment upon the choice of one of the two proposals.

Solution:**Statement Showing Computation of Profit at Present Position and Proposed Alternatives:**

Sl.	Particulars	Present Position	Sub Contract	Own Expansion
1	Option	1	2	3
2	Number of Units			
	Own	8,000	8,000	10,000
	Sub Contract	-	2,000	-
	Total	8,000	10,000	10,000
3	Sales (₹ Lakhs)	20.00	25.00	25.00
4	Variable Costs (₹ Lakhs)			
	Raw Materials	12.00	12.00	15.00
	Direct Wages	3.00	3.00	3.00
	Works Overhead (1.40 × 50%)	0.70	0.70	0.875
	Selling & Distribution Overhead (1.00 × 20%)	0.20	0.20	0.25
	Sub Contract Cost for 2000 units @ ₹ 225/- p.u.		4.50	
	Additional Workers (10 workers × ₹ 500(1+25%) × 12)			0.75
	Total	15.90	20.40	19.875
5	Contribution (30 4)	4.10	4.60	5.125
6	Fixed Costs	2.10 [W.N 3]	2.40 [W.N 4]	2.80 [W.N 5]
7	Profit	2.00	2.20	2.325

Comment: Option 3, i.e., own expansion gives the maximum profit of ₹2.325 lakhs and hence the same is recommended.

Working Notes:

- Works Overheads of ₹1.40 lakhs have been segregated into 50% fixed (i.e., ₹0.70 lakhs) and 50% variable (i.e., ₹0.70 lakhs).
- Selling & Distribution O H of ₹1.00 lakhs has been segregated into 80% fixed (i.e., ₹ 0.80 lakhs) and 20% variable (i.e., ₹ 0.20 lakhs).
- Fixed Costs in Option 1 (Present Position) consist of ₹ 0.70 lakhs of works overhead, ₹ 0.60 lakhs of Admn. Overhead and ₹ 0.80 lakhs of Selling & Distribution Overhead; all together aggregating to ₹ 2.10 lakhs.
- Fixed Costs in Option 2 (Sub Contract) consist of ₹ 2.10 as at present position and additional fixed expenses of ₹ 0.30 lakhs; both together aggregating to ₹ 2.40 lakhs.
- Fixed Costs in Option 3 (Own Expansion) consist of ₹ 2.40 as in Option 2, depreciation of ₹ 0.10 lakhs and interest on working capital of ₹ 0.30 lakhs; all together aggregating to ₹2.80 lakhs.

Illustration 12 (Make or Buy and Evaluation of Alternatives)

A Company manufacturing a highly successful line of cosmetics intends to diversify the product line to achieve

fuller utilization 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 grams 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 production for costing purposes.

The company estimated 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
All 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 and the cost of empty tubes, 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, new machine involving an additional fixed overheads ₹30,000 per month will have to be installed.

Required:

- State by showing your working whether 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.
- At what volume of sales will it be economical for the company to install the additional equipment for the manufacture of empty tubes?
- 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) Make or Buy

Total Cost per tube of EMO:

		Per Tube
Direct Material	= (108 ÷ 24)	= ₹4.50
Direct Wages	= (72 ÷ 24)	= ₹3.00
Variable Overheads	= {(54 ÷ 24) – (4,50,000 ÷ 3,00,000)}	= ₹0.75

Particulars	Total Cost (₹)	Tube Cost (₹)	Product Cost (₹)
Material	4.50	20% of total cost = 0.90	3.60
Wages	3.00	10% of total cost = 0.30	2.70
Variable Overhead	0.75	10% of total cost = 0.075	0.675
Total	8.25	1.275	6.975

$$\text{Cost of Making} = (3,00,000 \times 1.275) = ₹ 3,82,500$$

$$\text{Cost of Buying} = (3,00,000 \times 1.35) = ₹ 4,05,000$$

Therefore, It is better to make the tubes at 3,00,000 level of output, as it is cheaper than Buying.

Computation of Cost for additional tubes at the level of 3,50,000 and 4,50,000:

Particulars	3,50,000	4,50,000
Additional tubes needed over 3,00,000	50,000	1,50,000
Cost of Making (₹)	93,750 [(50,000 × 1.275) + 30,000]	2,21,750 [(1,50,000 × 1.275) + 30,000]
Cost of Buying (₹)	67,500 (50,000 × 1.35)	2,02,500 (1,50,000 × 1.35)

From the above, it is better to Buy the empty tubes at the level of 3,50,000 and 4,50,000, as it is deeper than making at both levels.

(ii) The level at which it is beneficial to make the tubes over and above 300000 units

$$\text{Additional Fixed Overheads} = ₹ 30,000$$

$$\text{Excess of buying cost over variable cost} = (1.35 - 1.275) = ₹ 0.075$$

$$\text{Indifference Point} = (\text{Additional Fixed Overheads} \div \text{Excess Buying Cost})$$

$$= 30,000 \div 0.075 = 4,00,000 \text{ units}$$

Therefore, the Company will be justified to install the additional Equipment for the manufacture of Empty tubes at a sales volume of 400000 units.

(iii) Evaluation of Profitability at the three levels of output

SL	Particulars	3,00,000	3,50,000	4,50,000
I.	Sales @ ₹ 10 p.u.	30,00,000	35,00,000	45,00,000
II.	Product Cost @ ₹ 6.975 p.u.	20,92,500 (3,00,000 × 6.975)	24,41,250 (3,50,000 × 6.975)	31,38,750 (4,50,000 × 6.975)
III.	Tube Cost (₹) [As per (i)]	3,82,500 (3,00,000 × 1.275)	4,72,500 (3,50,000 × 1.35)	6,07,500 (4,50,000 × 1.35)
IV.	Fixed cost (₹)	4,50,000	4,50,000	4,50,000
V.	Total Cost (₹)	29,25,000	33,63,750	41,96,250
VI.	Profit (I–V) (₹)	75,000	1,36,250	3,03,750

Illustration 13 (Evaluation of Alternative Choices)

ABC Computer Ltd. is planning to introduce a new computer “Speedo”. The maximum production capacity will be 40,000 units per annum. The company plans to produce full capacity in the first year. The cost per computer is as follows:

	(₹)
Direct material	6,000

Strategic Cost Management

Direct labour	5,000
Variable factory overheads	3,000

Fixed factory overheads is ₹1600 Lakhs and selling and distribution overheads will be ₹800 lakhs per annum. Fixed factory overheads are estimated on the basis of full capacity. The marketing department has come out with the following price and demand forecast for the first year.

Selling Price Range	Sales Volume
14001 -24000	36000
24001 – 30000	32000
30001 – 36000	18000
36001 – 42000	10000

ABC Computers has decided to price the computers at full cost plus 20% for the first year

- Work out the price/unit at which ABC wishes to sell the computer for the first year and arrive at the demand.
- Can you work out a better proposal?
- Determine the profit and the value of stock for year 1 for figures obtained under (a) above following Marginal cost approach (for the demand arrived at based on company's pricing policy for 1st year)
- Determine the profit and the value of stock for year 1 for figures obtained under (a) above following Absorption cost approach (for the demand determined for better proposal for 1st year)

Solution:

(a) Computation of Price/unit at which ABC wishes to sell the computer for the first year

Particulars	Per unit	Total for 40000 units
	(₹)	(₹ In Lakhs)
Variable Costs		
Direct Materials	6000	2400
Direct Labour	5000	2000
Variable factory overheads	3000	1200
Total Variable Costs	14000	5600
Fixed Costs		
Factory Overheads	4000	1600
Selling and Distribution overheads	2000	800
Total Fixed Costs	6000	2400
Total Costs	20000	8000
Add Markup @ 20%	4000	1600
Selling Price	24000	9600

At a selling price of ₹ 24,000 per unit, the maximum demand, as given in the price – sales matrices, is

36,000. Therefore, the price per unit at which ABC wishes to sell the computer for the first year is ₹ 24,000 units and the demand is 36,000 units.

(b) Workings for a better the Proposal

Volume	Max Selling Price per unit (₹)	Contribution per unit (₹) = (Price – Total Variable Costs of ₹ 14000)	Contribution for the entire Volume of Sales (₹ Lakhs)
36000	24,000	10,000	3,600
32000	30,000	16,000	5,120
18000	36,000	22,000	3,960
10000	42,000	28,000	2,800

The contribution is maximum (₹ 5,120 lakhs) at a sale volume of 32,000 units which, evidently, is a better proposal

(c) Determination of the profit and the value of stock for year 1 for figures obtained under (a) above following Marginal Cost Approach: (Demand as per First Year)

Number of units produced	=	40,000	
Number of Units to be sold	=	36,000	
Selling Price	=	₹ 24,000	
Contribution per Unit	=	₹ 10,000	(24,000 – 14,000)
Contribution for the entire volume of Sales	=	(36,000 × 10,000)	= ₹ 3600 lakhs
Fixed Costs = (Factory Overheads + Selling and Distribution Overheads)	=	1600 + 800	= ₹ 2400 lakhs
Profit on Sales = (Contribution – Fixed Costs)	=	(3,600 - 2,400)	= ₹ 1,200 lakhs
Closing Stock = (Production – Sales)	=	(40000 - 36000)	= 4000 units
Value of Closing Stock @ Marginal Cost	=	(4,000 × 14,000)	= ₹ 560 lakhs
Profit on Production	=	(1,200 + 560)	= ₹ 1,760 lakhs

(d) Determination of the profit and the value of stock for year 1 for figures obtained under (a) above following Absorption Cost Approach:

Number of units produced	=	40,000	
Number of Units to be sold	=	32,000	
Selling Price	=	₹ 30,000	
Contribution per Unit	=	₹ 16,000	
Contribution for the entire volume of Sales	=	(32,000 × 16,000)	= ₹ 5,120 lakhs
Fixed Costs Absorbed on No. of Units sold = (Factory Overheads @ ₹ 4,000 per unit + Selling and Distribution Overheads @ ₹ 2,000 per unit)	=	1,280 + 640	= ₹ 1,920 lakhs
Profit on Sales = (Contribution – Fixed Costs)	=	(5,120 - 1,920)	= ₹ 3,200 lakhs
Closing Stock = (Production – Sales)	=	(40,000 - 32,000)	= 8000 units
Rate per Valuation = (Variable Cost + Factory Overheads)	=	(14,000 + 4,000)	= ₹ 18,000

Value of Closing Stock @ Absorbed Cost	= (8,000 × 18,000)	= ₹ 1,440 lakhs
Profit on Production	= (3,200 + 1,440)	= ₹ 4,640 lakhs

Note: The aspect over absorption of overheads is not considered while computing the profit.

(Commentary: The problem reveals multiple conceptual dimensions during the course of evaluation of alternatives.)

Illustration 14 (BE Sales and Profit Analysis)

S K started a catering service to supply food to patients admitted in hospitals and those who were recovering from the pandemic. The cost of food and the disposable packing during a month of 30 days is ₹ 100 per meal. She sells each meal at ₹ 160. She has an arrangement with a delivery agency that quickly reaches for pick up and delivers to the customers. The agency charges her ₹ 120 per delivery, on condition that not more than 10 meals be transported by one person on one trip, i.e., ₹ 120 is charged irrespective of the number of meals subject to a maximum of 10 meals. She incurs a fixed expense of ₹ 1,44,000 per month.

- At what volume of sales will she break-even at the earliest? How many deliveries will be required?
- If she is able to sell 5000 meals in a month, what will be her maximum profits?
- What will be her worst income at this level? Assume she will not entertain any delivery for less than 3 meals per trip.

Solution:

(a) Break Even at the earliest and Number of Deliveries

The earliest break-even will occur when the transport cost per unit is the minimum, i.e., when all her sales are delivered in batches of 10. Then:

Cost of Food & Disposable Packing – ₹ 100

Delivery Cost = $120 \div 10 = ₹ 12$ per meal

Contribution per meal = $(160 - 100 - 12) = ₹ 48$.

Break Even Sales = Fixed Cost ÷ Contribution per Unit
 $= (1,44,000 \div 48) = 3000$ meals per month

Number of deliveries required = $(3000 \div 10) = 300$ per month

(b) Profit at maximum sales of 5,000 per month

Contribution at a sale of 5,000 meals = $5000 \times 48 = ₹ 2,40,000$

Fixed Cost = ₹ 1,44,000

Profit = $(2,40,000 - 1,44,000) = ₹ 96,000$

(c) Worst income at the level of 5,000 meals

Contribution per Meal before delivery Cost = $(160 - 100) = ₹ 60$

Delivery cost at 3 meals per delivery = $(120 \div 3) = 40$

Contribution per meal = $(60 - 40) = ₹ 20$

Contribution at a sale of 5,000 meals = $5000 \times 20 = ₹ 1,00,000$

Profit = $(1,00,000 - 1,44,000) = (₹ 44,000)$

In a worst situation the loss is ₹ 44,000

Illustration 15 (Fixation of Selling Price)

Look Ahead Ltd. wants to fix proper selling prices for their products 'A' and 'B' which they are newly introducing in the market. Both these products will be manufactured in Department D, which is considered as a Profit Centre.

The estimated data are as under: -

	A	B
Annual Production (units)	1,00,000	2,00,000
	₹	₹
Direct Materials per unit	15.00	14.00
Direct Labour per unit	9.00	6.00

(Direct Labour Hour Rate = ₹ 3)

The proportion of overheads other than interest, chargeable to the two products are as under:

Factory overheads (50% fixed) 100% of Direct Wages. Administration overheads (100% fixed) 10% of factory costs. Selling and Distribution overheads (50% variable) ₹ 3 and ₹ 4 respectively per unit of products A and B.

The fixed capital investment in the Department is ₹50 lakhs. The working capital requirement is equivalent to 6 months stock of cost of sales of both the products. For this project a term loan amounting to ₹40 lakhs has been obtained from Financial Institutions on an interest rate of 14% per annum. 50% of the working capital needs are met by bank borrowing carrying interest at 18% per annum. The Department is expected to give a return of 20% on capital employed.

You are required to:

- Fix the selling price of products A and B such that the contribution per direct labour hour is the same for both the products.
- Prepare a statement showing in details of the overall profit that would be made by the Department.

Solution:**(a) Fixation of Selling Price****Step 1: Statement of Cost**

Element	Product A Amount (₹)	Product B Amount (₹)
Direct Material	15	14
Direct Labour	9	6
Prime Cost	24	20
Factory Overhead (100% on Direct Labour)	9	6
Factory Cost	33	26
Administration Overhead (10% of Factory Cost)	3.30	2.60
Cost of production	36.30	28.60
Selling and Distribution	3	4
Cost of Sales per Unit	39.30	32.60

Step 2: Computation of Variable Costs

Element	Product A Amount (₹)	Product B Amount (₹)
Prime Cost	24	20
Variable Factory Overhead (9 × 50%) & (6 × 50%)	4.50	3
Variable Selling and Distribution (50% of 3) & (50% × 4)	1.50	2
Total	30	25

Step 3: Computation of Required Return on Total Capital Employed

Description	Workings	(₹)
Fixed Capital		50,00,000
Working Capital		
A	$(1,00,000 \div 2) \times 39.30 = 19,65,000$	
B	$(2,00,000 \div 2) \times 32.60 = 32,60,000$	
Total Working Capital (A + B)		52,25,000
Total Capital employed (Fixed Capital + Working Capital)		1,02,25,000
Required Return @ 20% on Total Capital employed		20,45,000

Step 4: Computation of Required Contribution

Description	Workings	(₹)
Cost of Sales		
A	$1,00,000 \times 39.30 = 39,30,000$	
B	$2,00,000 \times 32.60 = 65,20,000$	
Total Cost of Sales		1,04,50,000
Required Return @ 20% on Total Capital employed (Step 3)		20,45,000
Required Sales Value	$(1,04,50,000 + 20,45,000)$	1,24,95,000
Variable Cost		
A	$1,00,000 \times 30 = 30,00,000$	
B	$2,00,000 \times 25 = 50,00,000$	
Total Variable Cost		80,00,000
Required Contribution	$(1,24,95,000 - 80,00,000)$	44,95,000
Required Contribution	$(1,24,95,000 - 80,00,000)$	44,95,000
Labour Hours		
A	$1,00,000 \times 3 = 3,00,000$	

Description	Workings	(₹)
B	$2,00,000 \times 2 = 4.00,000$	
Total Labour Hours		7,00,000
Contribution per hour	$44,95,000 \div 7,00,000$	6.4214
Contribution for unit of 'A'	3×6.4214	19.2643
Contribution for unit of 'B'	2×6.4214	12.8428

Step 5: Computation of Selling Price

Element	Product A Amount (₹)	Product B Amount (₹)
Variable cost (Step 2)	30.00	25.00
Add: Required Contribution (Step 4)	19.2643	12.8428
Selling Price	49.2643	37.8428

(b) Statement showing in details of the overall profit that would be made by the Department

Serial	Element	Amount (₹)
1	Sales	1,24,95,000
2	Cost	1,04,50,000
3	Profit Before Interest	20,45,000
4	Interest on term loan ($40,00,000 \times 14\%$)	(5,60,000)
5	Interest on Working Capital (50% of $52,25,000 \times 18\%$)	(4,70,250)
6	Profit	10,14,750

Illustration 16 (Fixation of Selling Price)

S.V.Ltd budgets to make 1,00,000 units of product P. The variable cost per unit is ₹ 10. Fixed costs are ₹6,00,000. The Finance Director suggested that the cost-plus approach should be used with a profit mark-up of 25%. However, the Marketing Director disagreed and has supplied the following information:

Selling Price per unit (₹)	Demand (Unit)
18	84,000
20	76,000
22	70,000
24	64,000
26	54,000

As Management Accountant of the Company, analyse the above proposals and comment.

Solution:

Calculation of selling price as per Finance Director's approach

	Amount (₹)
Variable Cost	10
Fixed Cost ₹ (6,00,000/1,00,000)	6
Total Cost	16
Add: Profit mark up 25%	4
Selling Price	20

Evaluation of Marketing Director's Proposal

Selling Price	Contribution per unit (SP – VC)	No. of units	Total contribution	Fixed Cost	Profit
(₹)	(₹)		(₹)	(₹)	(₹)
18	8	84,000	6,72,000	6,00,000	72,000
20	10	76,000	7,60,000	6,00,000	1,60,000
22	12	70,000	8,40,000	6,00,000	2,40,000
24	14	64,000	8,96,000	6,00,000	2,96,000
26	16	54,000	8,64,000	6,00,000	2,64,000

Comment: At the selling price of ₹ 24 per unit, the profit is maximum and hence that price must be fixed for the product.

Pricing Decisions and Strategies

3.2

Concept

Pricing can make or break a business. Setting prices for the products or services does not simply come down to a simple calculation. Prices can be practical tools for making ends meet. To figure out the best way to set prices, it is worthwhile to examine the idea of what the business wants that its pricing strategy should achieve.

Product prices determine the revenue stream of a business. Prices must be sufficient to cover the costs and profit. Before lowering prices, it is preferable to lower costs to maintain a stable profit margin and a stable cash flow into the business. Any pricing strategy must be chosen to ensure a maximum profit. Knowing the market and customer base are key elements to choosing the right pricing strategy.

Key Strategies

The key pricing strategies may, broadly, be listed as:

- i. Profit Orientation
 - ii. Competition Based
 - iii. Demand Based
 - iv. Cost Plus
 - v. Mark-up
- i. Profit-Oriented:** In a sense, all pricing strategies are profit-oriented because, even if the prices are set with other objectives in mind, the entity still needs to earn a profit to stay in business. Profit-oriented pricing makes profit the top priority when figuring out the ideal price to set. A profit-oriented pricing strategy looks for the sweet spot that allows the entity to charge as much as possible for the offerings without charging so much that potential customers are alienated and money is lost through missed sales. This type of pricing objective can either aim to maximize profit per unit relative to cost of goods sold and other operating costs, or it can aim to maximize the overall profit by setting a price that is competitive enough to increase the overall number of units you sell.
- ii. Competitor-Based Pricing:** Competitor-based pricing uses the price that is set to appeal to customers and define the niche relative to the entity's competitors. Competitive pricing is charging a price that is comparable to other vendors selling the same item. It does not necessarily rely on setting a lower price than other available options, although this strategy will certainly make the products appeal to customers who shop on the basis of price alone. One can also use competitor-based pricing effectively by setting a price that is in the same ballpark as other products in the same niche, or by choosing a higher price to send the message that the entity's product is superior and worth the extra money.

Selling a well-established product at a similar price to competitors is an option for small retailers who want to draw customers to their businesses. Keeping customers there, however, often means distinguishing

themselves on bases other than price. Relying on a competitive pricing strategy may be risky if volume cannot be maintained or if costs suddenly rise.

Vendors use a competitive pricing strategy when several other businesses sell the same product and there is little to distinguish from one vendor from another. A market leader will generally set the price for the product and other vendors will usually have no option but to follow suit in order to remain competitive. Vendors will either match the pricing of the market leader or set prices within a comparable range.

Vendors who are not market leaders can use the accepted price as a starting point. From there they can opt to charge slightly more on the basis of factors such as superior customer service or an extended warranty on a product. Retailers must be fully informed of the prices their competitors charge and also know how discerning their customers are on price alone. Once price is established, sales volume must be monitored to see if the strategy is working.

- iii. **Demand Based:** Demand Based Pricing is a pricing method based on the customer's demand and the perceived value of the product. In this method the customer's responsiveness to purchase the product at different prices is compared and then an acceptable price is set. Demand pricing is determined by establishing the optimal relationship between profit and volume; a smaller per-unit profit is acceptable if volume is increased significantly. Demand based pricing includes Price Skimming, Price Discrimination and Price Penetration.

In case of Price Skimming, the initial price is set very high so that only the customers with more purchasing power can buy the product. After that the price is reduced gradually so that the price-sensitive customers who were not able to buy the product at first can now buy. Finally, the price at which the company can operate in profit is set up. This way a company gets ahead of any competition and by the time other companies can come to the market this company already makes the profit. In general, electronic products are priced this way. If customers are passionate about the entity's products and willing to pay extra to be the first to have them, one can charge initial high prices when the entity first introduces a new innovation or a new line, and then lower the prices after attracting the people who are willing to pay more. Eg. Apple follows Price Skimming.

Price Discrimination is where customers are charged differently based on different demand levels. For example, the airline ticket prices increase as the travel date gets closer. Inelastic demand during the end makes the price very high. Another type of price discrimination is when customers in different markets/areas are charged differently for the same product or service.

Price Penetration is the exact opposite to the price skimming. In this method the initial price is kept really low to attract more customers and increase the market share. Discounts, inaugural price, first 100 buyers etc are some of the methods. Price penetration strategy can be risky because customers do not like growing prices, once accustomed to a low price and then being asked to pay more. However, this approach can be successful if the products really do have features other than price that will make customers want to buy them, such as unique features or unusually high quality. E.g. Initially during the launch, Jio used Price Penetration.

- iv. **Cost Plus Pricing:** In cost-plus pricing, a set profit margin is added to the total cost of a product -- including materials, labour and overhead. In cost-plus pricing, a company first determines its break-even price for the product. This is done by calculating all the costs involved in the production, marketing and distribution of the product. Then a markup is set for each unit, based on the profit the company needs to make, its sales objectives and the price it believes customers will pay.

Cost plus also is used to price large development projects, particularly in government contracts. It is not always easy to predict the total amount of money needed to design or build an aircraft carrier or a new piece of military equipment, for example. Instead, companies estimate the amount of work needed and the time it will take to complete and then specify how much profit they will charge over and above the final cost of the project.

Another area that applies cost-plus pricing is services, particularly those provided to Central and State governments by large and small businesses. Some examples are contractor support services and logistics support. In this case, the government often buys a certain number of hours of work from the contractor at a fixed price, plus a percentage of profit.

Cost-plus pricing, commonly, is used in processing credit card transactions. A pricing system called e-interchange plus adds a merchant service provider's fee to the rate charged by the credit card provider for each transaction. This price model is good for merchants because it tells them exactly how much each credit card transaction will cost them to process.

One problem with cost-plus pricing is that it does not take into account the price of competing products. If a competing product is selling for less, cost-plus may not be a good strategy. Cost-plus pricing also ignores what the product is worth to the buyer. Buyers may be willing to pay more for some products. A cost-plus strategy may not be responsive to changes in the market and can be an obstacle to long-term success.

- v. **Mark-up pricing:** Mark-up pricing is where a percentage is added to the wholesale cost of a product. Mark up refers to the value that a firm adds to the cost price of a product. The value added is called the mark-up. The mark-up added to the cost price usually equals retail price. The difference between cost plus pricing and mark-up pricing is hair-thin and both the terms are used one for the other very often.

For example, a FMCG company sells a bar of soap to the retailer at ₹ 10. This is the cost price. The retailer adds ₹ 2 as his value and sells the soap to the final consumer at ₹ 12. The margin of ₹ 2 between the cost price and MRP is the mark-up.

The amount of mark-up allowed to the retailer determines the money he makes from selling every unit of the product. Higher the markup, greater the cost to the consumer, and greater the money the retailer makes. In FMCG, typically, the MRP is low and the retailer is allowed a lower markup, from anywhere between 5% and 8%. Low margins mean a retailer makes less money on every unit, but the number of units sold is very high in FMCG. So overall, the amount of money made evens out.

A well-established FMCG company like Hindustan Uni Lever can give less margins to the retailers because the volume of sales of its wide range of products is very high. On the other hand, a new and unknown product and company will need to pay more margins to the retailers to entice them to stock the product in the first place.

Effective Pricing

Effective Pricing is the one that satisfies all the stakeholders, viz. the producer, distributor and the consumer. It fits into the criteria of profit orientation, competition, demand base as also the cost plus and markup. In a way it may be called long run calibrator of price equilibrium over a business cycle. It is the price set by the producer and accepted by all. It is what all stakeholders can bear.

Steps involved in determining an effective price may be listed as:

- i. Analysis of Financial Statements
- ii. Analysis of Cost Behaviour
- iii. Analysis of the Profit Gap
- iv. Evolving Cost Reduction Strategies
- v. Determination of Feasible Prices for different Capacity level
- vi. Determination of Effective Price
- vii. Establishing Cost Controls
- viii. Review, Revise and Reset

Three important approaches that warrant discussion in relation to effective pricing are:

- (i) Product Differentiation
- (ii) Cost Leadership
- (iii) Yield Management

(i) Product Differentiation

Product Differentiation is the process of distinguishing a product or service from others, to make it more attractive to a particular target market. This involves differentiating it from competitors' products as well as the firm's own products¹.

The strategy of Product Differentiation is adopted to build up specific competitive advantages over competitors by tapping the unique resource endowments exclusive to an entity. The major sources of product differentiation may be traced to differences in quality, differences in functional features, and differences in availability (e.g., timing and location).

The objective of differentiation is to develop a position that potential customers see it as unique. As a result, the unique features of the product create a perception of esteem value for the product, which goes beyond pricing considerations. Well established differentiation makes customers in a given segment develop a lower sensitivity to the non-price features of the product.

Many a time product differentiation is driven by the factors of esteem value. The implication of differentiation often enables the possibility of charging a price premium.

One of the innovative research papers observes that the growing market of physically challenged persons can be a source of competitive advantage for the airlines if they differentiate their products and services by fulfilling the needs of the physically challenged. That is where the innovative value of Product Differentiation could lie.

(ii) Cost Leadership

Cost Leadership is a generic strategy adopted to gain competitive advantage. The Strategy aims at the firm winning market share by appealing to cost-conscious or price-sensitive customers. This is achieved by having the lowest prices in the target market segment, or at least the lowest price to value ratio (price compared to what customers receive). To succeed at offering the lowest price while still achieving profitability and a high return on investment, the firm must be able to operate at a lower cost than its rivals.

Cost leadership strategy drives the management to constantly work on reducing costs at every level and to remain competitive as also profitable. The three-fold dimensions, in this context, consist of:

- (a) Optimum Utilisation of Assets
- (b) Cost Conscious Culture
- (c) Concurrent Value Chain Control

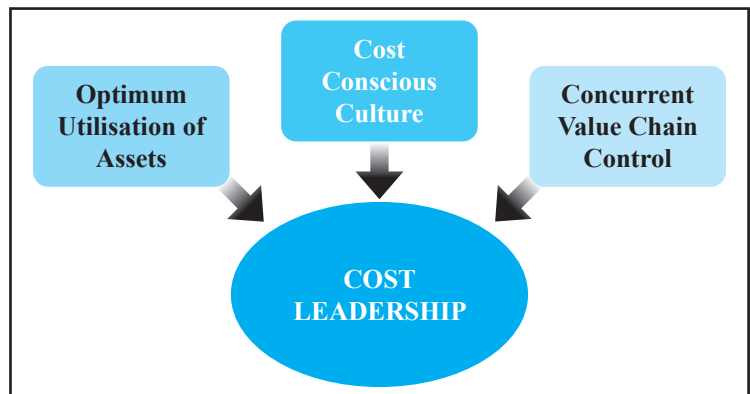


Figure 3.3 : Dimensions of Cost Leadership

¹ The concept was proposed by Edward Chamberlin in 1933 in his 'Theory of Monopolistic Competition'.

- (a) **Optimum Utilisation of Assets:** The first and foremost is achieving a high asset utilization. In manufacturing, it will involve production of high volumes of output. In service industries, this may mean for example a restaurant that turns tables around very quickly, or an airline that turns around flights rapidly. These approaches mean fixed costs are spread over a larger number of units of the product or service, resulting in a lower unit cost, i.e., the firm hopes to take advantage of economies of scale and experience / learning curve effects. For industrial firms, mass production becomes both a strategy and an end in itself. Higher levels of output both require and result in high market share, and create an entry barrier to potential competitors, who may be unable to achieve the scale necessary to match the firms low costs and prices.
- (b) **Cost Conscious Culture:** The second dimension is inculcating a cost conscious culture across the organisation and achieving low direct and indirect operating costs. This is achieved by offering high volumes of standardized products, offering basic no-frills products and limiting customization and personalization of service. Production costs are kept low by using fewer and standard components, and limiting the number of models produced to ensure larger production runs. Overheads are kept low by collective efforts. Maintaining this strategy requires a continuous search for cost reductions in all aspects of the business. This will include outsourcing, controlling production costs, increasing asset capacity utilization, and minimizing other costs including distribution, R&D and advertising. The associated distribution strategy is to obtain the most extensive distribution possible. Promotional strategy often involves trying to make a virtue out of low-cost product features.
- (c) **Concurrent Value Chain Control:** The third dimension is control over the value chain encompassing all functional groups (finance, supply/procurement, marketing, inventory, information technology etc..) to ensure low costs. For supply/procurement chain this could be achieved by bulk buying to enjoy quantity discounts, squeezing suppliers on price, instituting competitive bidding for contracts, working with vendors to keep inventories low using methods such as Just-in-Time purchasing or Vendor-Managed Inventory. Wal-Mart is famous for squeezing its suppliers to ensure low prices for its goods. Other procurement advantages could come from preferential access to raw materials, or backward integration. Keep in mind that if you are in control of all functional groups this is suitable for cost leadership; if you are only in control of one functional group this is differentiation. For example, Dell Computer initially achieved market share by keeping inventories low and only building computers to order via applying Differentiation strategies in supply/procurement chain.

Cost leadership strategies are certainly viable for large firms with the opportunity to enjoy economies of scale and large production volumes and big market share. Small businesses can be “cost focused”, but not “cost leaders” if they enjoy any advantages conducive to low costs. For example, a local restaurant in a low rent location can attract price-sensitive customers if it offers a limited menu, rapid table turnover and employs staff on minimum wage. Innovation of products or processes may also enable a startup or small company to offer a cheaper product or service where incumbents’ costs and prices have become too high. An example is the success of low-cost budget airlines who, despite having fewer planes than the major airlines, were able to achieve market share growth by offering cheap, no-frills services at prices much cheaper than those of the larger incumbents. At the beginning, low-cost budget airlines chose “cost focused” strategies but later when the market grew, big airlines started to offer the same low-cost attributes, and so cost focus became cost leadership!

A cost leadership strategy may have the disadvantage of lower customer loyalty, as price-sensitive customers will switch once a lower-priced substitute is available. A reputation as a cost leader may also result in a reputation for low quality, which may make it difficult for a firm to rebrand itself or its products if it chooses to shift to a differentiation strategy in future.

The low-cost leadership strategies are prone to be imitated by the competitors as well, and Thus, low-cost leadership is not a one time process. A successful way of adopting this strategy can be by using

the Japanese mantra of “Kaizen” that focuses on continuous improvement. Target Costing is perceived as the most effective means in this direction. Continuous rethinking is important for the implementers of this strategy. Continuous efforts to improve the operations and reduce the costs make an entity more efficient, effective and economical, in comparison to its competitors, which in turn lead to higher profit margins for the entity as a whole.

The higher profitability of the cost leaders gives them enough space to innovate, manoeuvre, and survive as compared to their lower-margin competitors, especially in price centered industries. It also acts as a strong barrier for the entry of new competitors. As such, cost leadership strategy is factored to bring in competitive advantage over the long run. Global giants Wal-Mart and McDonalds are cited as interesting examples of being cost effective leaders in their respective fields.

In the Indian perspective, Big Bazaar is, often, mentioned as one example that has been focusing on low-cost leadership strategy. The major USP of ‘Big Bazaar,’ is low pricing. Big Bazaar sells the same branded products that the other retailers are also selling; but it sells these products at a price, assumably, ten to fifteen percent lower than that of the others.

“Cost Leadership is fostered by continuous Cost Reduction”. Ultimately, it is the magnitude of successful implementation of ‘Cost Leadership Strategy’ that determines the leader amongst the peers.

(iii) Yield Management

The core strength of Cost Management is ‘Prudent Deployment and Optimum Utilisation of the Available Resources’. At the same time, it is one of the biggest challenges too for every Cost Manager, for many a resource tends remain idle for incomprehensible reasons. It could be an unfilled seat in a flight, a vacant berth in a train, an unoccupied hotel room, or an empty bed in a hospital. In all such eventualities, capacity unutilised is revenue lost. Yield Management, also known, as Revenue Management is the innovation that addresses the ticklish issue of underutilisation of available capacity.

Deregulation is generally regarded as the catalyst for yield management in the airline industry. As the history would have it, Yield Management was devised by American Airlines in 1985 to overcome the stiff competition posed by PeopleExpress. The Airline Deregulation Act in 1978 in USA paved the way for deregulation of the airline industry in USA and facilitated the entry of new players into the sector. It also enabled flexibility in determining the fares and schedules. This was a huge change from a totally restricted industry to complete freedom for the Aviation Industry in America. PeopleExpress was one of the new entrants into aviation, almost 70% smaller than the then bigger airlines, but started offering very low competitive fares. The cut throat competition dented the bigger airlines severely, American Airlines being the most affected.

On January 17, 1985, American Airlines launched its “Ultimate Super Saver Fares”. People thought it was a joke, a final attempt to avoid bankruptcy, but it was real. American introduced low fares, just like PeopleExpress, or in some cases even lower. There were only two differences:

- a. If a passenger wanted to purchase an “Ultimate Super Saver fare” he had to book at least two weeks prior to departure, and stay at his destination over a Saturday night.
- b. The number of seats that could be sold for the discounted price was restricted. In this way American could save seats for full fare customers who book just days before departure.

With these two changes American Airlines segmented the market between leisure travelers and business travelers. Both segments preferred the major airline’s better service. As a result, eventually PeopleExpress was pushed to the edge. That is how; Yield Management is stated to have come into effective practice. The concept spread to the other travel and transportation companies in the early 1990s, and gradually to many other sectors all over the world.

Concept: Yield Management is a set of revenue maximization strategies and tactics meant to improve the business profitability. It is a technique that determines the best pricing policy for optimising profits. It adopts the principle of pricing the products and services at what the market can bear. In the process, it facilitates optimum utilisation of the resources.

Yield management was devised as the scientific way of dynamically managing prices, inventories, and capacities of perishable services. It is a scientific technique that combines Operations Research, Statistics and Customer Relationship Management (CRM); and categorizes customers into price bands. It is the process of understanding, anticipating and influencing consumer behaviour in order to maximize revenue and profits from fixed and perishable resources such as airline seats, hotel rooms, hospital beds, etc. The underlying challenge is to sell the right resources to the right customer at the right time for the right price. The process may lead to price discrimination, wherein an enterprise charges different prices to different customers for identical goods or services.

Yield management is a large revenue generator for several major industries. The general principles of revenue management are widely applicable all across, even though each particular application needs to carefully address the requirements of a specific industry. It is the art and science of price-driven and capacity-based profit maximization. It is a proven technique that helps service industries to maximize revenue.

Yield Management involves several aspects of management control, including price management, revenue streams management, and distribution channel management, just to name a few. It is a multidisciplinary strategy that blends the elements of marketing, operations, and financial management into a highly successful integrated approach. A revenue manager ought to work in cohesion with the other departments while designing and implementing revenue management strategies.

Yield Management Strategy is being used by many a sector such as Aviation, Hospitality, Health Care, Power Distribution, Telecommunications, etc. The demonstrative examples include lower tariffs for advance reservation by airlines; weekend discounts by hotels; time sensitive tariffs by power generation & distribution companies; the differential pricings adopted by Telecom Services, Broadcasting Media, Railways, and so on.

Features

The industries that are amenable to the strategy of Yield Management do exhibit specific features such as Fixed Capacity, Perishable Products, Low Marginal Costs, Price Elastic Demand, Segmented Market, and Advance Booking of the products and services that are being offered.

Fixed Capacity: The first of the precincts, governing yield management, is that the quantum of the products or services available for sale is governed by the principle of Fixed Capacity. In relation to the airline industry seats are the products; in case of hotel industry hotel rooms are the products; and the capacity of hospitals is the number beds they have for patients. The capacity of the seats in a flight remains fixed as also the rooms in a hotel or beds in a hospital.

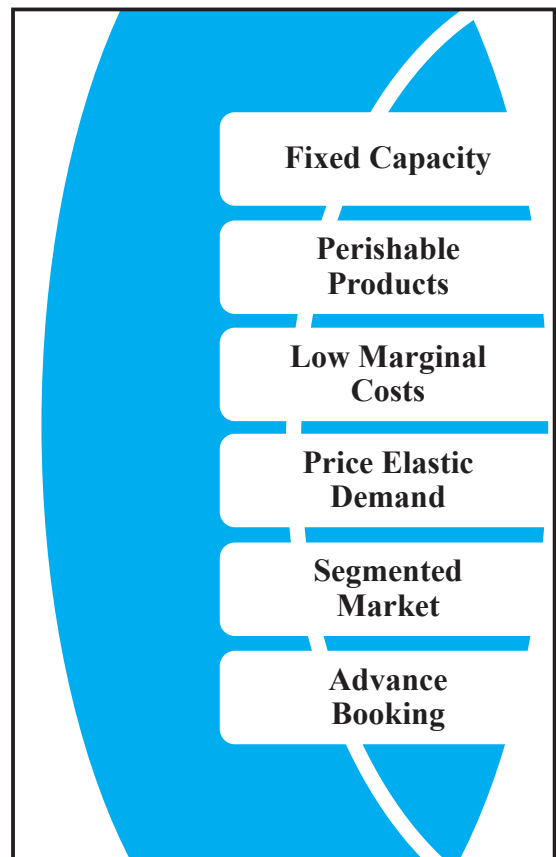


Figure 3.4: Features of Yield Management

In line with the upward and downward swings in demand, it is not feasible to add extra seats for any particular trip of a flight, reduce the rooms in a hotel, or do away with some beds in a hospital - on a day-to-day basis. The capacity of the enterprise, thus, remains constant for the time being.

Perishable Products: The second of the precincts relates to the perishable character of the products and services. The life span of the products and services is very limited in character; the products and services tend to perish after a time limit; and they cease to be of no value thereafter. An airline seat that remains vacant for the trip or a hotel room that remains unoccupied for a night or a hospital bed that does not have a patient for the day - adds no value at all for the period. These products and services cannot be stored in a warehouse and their value cannot be preserved. If not sold in time, the value is lost forever.

Low Marginal Costs: Yield management is of especially high relevance in cases where the fixed costs are relatively high compared to the variable costs. Such of these industries are heavily capital intensive with high fixed costs and low marginal costs. Once the capacity is created by incurring the fixed (capacity) costs, the cost of serving an additional customer is quite meagre. Rationally, an additional unit of the product can be offered at a lower margin if the demand can be increased. The high fixed cost and low marginal cost nature of the business enables the application of price differentiation as a tool to generate additional revenues. The fundamental principle is that the sales can be pushed up till the point that marginal revenue continues to be greater than marginal costs.

Price Elastic Demand: The Demand for the products and services where Yield Management can be applied is characterized by price elastic demand. Lower prices would draw more customers whereas higher prices would wean away the unwilling customers. There could also be seasonal fluctuations in the demand. In that, in peak season, the supplier can increase the revenues by raising the prices, while during lean season the sale volumes can be maintained by lowering prices. A higher profit through higher prices is the guiding parameter for peak season; and better capacity utilisation through lower prices happens to be the key strategy to tide over the pitfalls of slack season. Past data will offer the manager a way to forecast as to when and how these periods of high and low demand may occur.

Segmented Market: The market for the products and services is segmented wherein different classes of customers are willing to pay different prices for using the same amount of the products or services. If all customers would pay the same price for using the same quantum of resources, the challenge would perhaps be limited to selling as quickly as possible and minimize the holding costs. Airlines and Hotels typically segment their customer base into a set of categories based on the price each category is willing to pay. Typical categories include the business traveller and the vacation traveller, because demand patterns for each of these categories may vary significantly, the service providers find it difficult to satisfy all of the demand simultaneously.

A good example is the comparison between the time-conscious business executive and the price sensitive vacation customer. The former is willing to pay a higher price in exchange for flexibility of being able to book at the last minute while the latter is willing to give up some flexibility for the sake of a more inexpensive pricing. Yield Management tries to maximize revenues by managing the trade-off between a low occupancy and higher rate scenario of business customers versus a high occupancy and lower rate of vacation customers. Such a strategy allows airlines and hotels to fill the seats and rooms that would otherwise have been empty.

Advance Booking: More often than not, requests for bookings of the products and services start early. It could be an airline seat, hotel room, or a maternity bed; enough scope exists for the customer to foresee a time line and make the reservations well in advance. Therefore, the suppliers have enough leeway to adjust prices based on the variation between advance bookings and expected demand. If all products are sold at the same time, the supplier does not have the flexibility to adjust prices upward if demand picks up later. The trade-off occurs when a supplier is faced with the option of accepting an early reservation from a customer who wants a low price, or waiting to see if a higher paying customer will eventually show up.

The Process

The system of Yield Management is based on optimization methodologies developed from advanced statistical and analytical models. In order to arrive at a solution, the processors need to evaluate several decisions, which require a significant investment of skills, hardware and time.

Many Yield Management practitioners prefer to breakdown the actual business scenario into four sub-problems, viz. Identification of Market Segments, Forecasting and Pricing, Segment-wise Allocation of Inventory, and Overbooking. An individual solution to some or all of these sub-problems is arrived thereafter. This would significantly reduce the number of potential non-optimal decisions thereby providing fewer choices, leading to quicker results.

Identification of Market Segments: The first and foremost step in Yield Management system is the identification of the various market segments for the products and services, followed by implementation of a differential pricing scheme. The objective is expansion of the market through customer temptation. In relation to aviation, it may be observed that customers in the business class segment are less sensitive to higher prices as opposed to those in the vacation segment. Yield Management system helps the service providers to create additional price-points by building physical and logical fences around the different market segments.

Forecasting and Pricing: The next step in Yield Management process is forecasting demand and pricing of the different market segments. Pricing and demand are inter-related and need to be coordinated. Considering the example of the hotel industry, demand for a room is cyclical in nature depending upon the day of a week or months of a year and follows a trend of demand growth due to economic upswing. These forecasts are seldom precise but provide the decision-maker with an approximate set of inputs that are used in the planning process. Yield Management models help pinpoint demand by minimizing uncertainty and producing the best possible forecast.

Segment-wise Allocation: The next important step in a Yield Management process is the allocation of the products and services to different market segments. The ratio of discounted versus full priced products is not fixed during the reservation period; rather, it is tweaked appropriately as the date of providing the service approaches. The opportunity cost of selling a discounted product instead of a full priced one has to be measured in order to make the best decision. Thus, when a customer approaches the hotel for a discounted price, the manager needs to evaluate this scenario with the expected revenue from another customer who might come at a later date, willing to pay a higher price for the same room. The manager would accept the request only if the discounted price now is more than the expected price at which the room might be booked by the second customer. The key word here is 'expected'. Yield Management systems use mathematical algorithms to arrive at this decision using techniques such as Littlewoods and Expectation Maximization, referred to as the EM algorithm.

Over-booking: Overbooking is the practice of intentionally selling more products than are available in order to offset the effect of cancellations and no-shows. Studies estimate that although a hotel is fully booked, a small percentage of the rooms may remain vacant on any given date. Poor overbooking decisions can prove to be very expensive for the hotel. In the short run, it is only a loss of room revenue, but over the long-term, casualties may include decreased customer loyalty, loss of hotel reputation, etc. American Airlines developed an optimization model that maximizes net revenues associated with overbooking decisions for the airline industry. The driving force behind the model is the evaluation of the trade-off between additional revenue accrued by selling an already-reserved seat versus the downside from doing so. It has been found that net revenue increases with overbooking

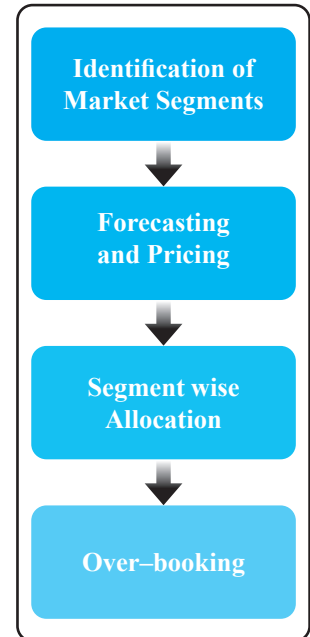


Figure 3.5: Process of Yield Management

until the point where the downside from overbooking a seat exceeds customer revenues. Beyond that point, the negative impact of overbooking increases rapidly because fewer and fewer customers appreciate being turned away.

Complexities

Yield Management system does enable increased revenues; at the same time, it can be quite complicated to design; and requires high levels of expertise for implementation. Some of the concerns being faced by the industry in the implementation of a robust and accurate Yield Management system may be stated as difficulties in performance measurement, impact on customer loyalty, impact on employee motivations and certainty in customer response.

Performance Measurement: Measuring performance of any Yield Management system is a major issue. Occupancy rates and yield are measures that are affected by external competition. An ideal measurement can be done using an opportunity model that indicates where the company stands in comparison to its maximum.

Customer Loyalty: Differential pricing is here to stay and customers seem resigned to the fact that the service provider charges different prices for the same service. However, some customers do not like this practice and penalize the service provider by not becoming a patron. Therefore, in a fiercely competitive environment where quality of service is the key to success, Yield Management may not work. In evaluating the efficiency of a Yield Management system, the trade-off between generating short-term profits and creating long-term customer loyalty and mindshare needs to be studied carefully.

When Yield Management was introduced in the early 1990s, primarily in the airline industry, many suggested that despite the obvious immediate increase in revenues, it might harm customer satisfaction and loyalty, interfere with relationship marketing, and drive customers from firms that used Yield Management to firms that do not use Yield Management. To some extent, frequent flier programs were developed as a response to regain customer loyalty and reward frequent & high yield passengers. Today, Yield Management is nearly universal in many industries, apart from airlines.

Employee Motivations: From an operational point of view, Yield Management can impact the motivational level of the employees. In many cases, Yield Management takes much of the guess work out of employees, thereby reducing their decision-making responsibilities. Sometimes, employees taking reservations are paid a percentage of the sales they make, motivating them to make group bookings, which in turn may be contradictory with the objectives of a Yield Management system.

Customer Response: Despite optimising revenue in theory, introduction of yield management can sometimes fail to achieve this in practice because of corporate image problems. In 2002, Deutsche Bahn, the German national railway company, experimented with yield management for frequent loyalty card passengers. The fixed pricing model that had existed for decades was replaced with a more demand-responsive pricing model, but this reform proved highly unpopular with passengers, leading to widespread protests and a decline in passenger numbers. Yield Management would be successful only if customer response can be gauged properly.

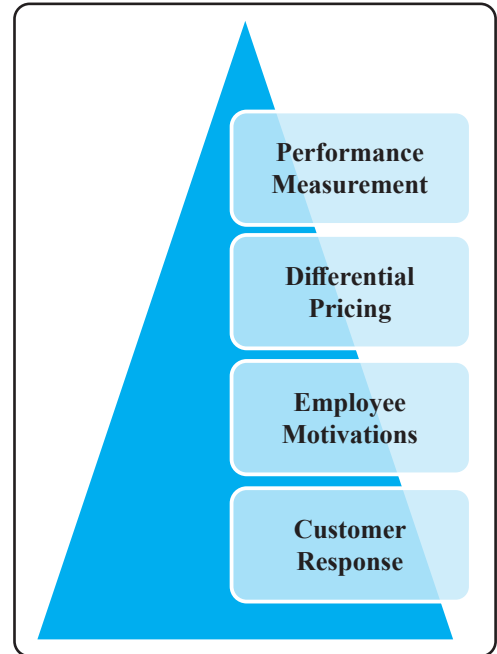


Figure 3.6: Complexities of Yield Management

Capacity Optimisation

Adoption of Yield Management implies predicting potential capacity, and developing a pricing strategy that will enable optimum capacity utilisation and maximum revenue. Yield Management attempts to derive the operational solutions by means of methods similar to aggregate and hierarchical production planning techniques often employed in the manufacturing industry.

Firms that engage in yield management usually use software-based systems to do so. The Internet has greatly facilitated this process. Enterprises that use yield management periodically review transactions for goods or services already supplied and for goods or services to be supplied in the future. The models attempt to forecast total demand for all products or services they provide, by market segment and price point. Since total demand normally exceeds what the particular firm can produce in that period, the models attempt to optimize the firm's outputs to maximize revenue.

The optimization attempts to answer the question: Given our operating constraints, what is the best mix of products and or services for us to produce and sell in the period, and at what prices, to generate the highest expected revenue? Optimization can help the firm adjust prices and to allocate capacity among market segments to maximize expected revenues.

Taking the example of airlines, the passenger capacity is fixed for every scheduled flight; and when the aircraft departs, the unsold seats can be said to have perished. Selling of these vacant seats even at lower prices would lead to augmentation of the trip revenues and better utilization of passenger capacity; and that is where revenue management comes into play.

Airlines keep monitoring the trend of reservations and respond by offering the probable vacant seats at discounted prices to leisure travellers. Statistical analysis of past data helps in forecasting demand and establishing the appropriate price bands. The same modus operandi can be extended to Hotels, Car Rentals, Road Transport, Rail Transport, Hospitals, Stadiums, Cinema Halls, Apartment Housing, and so on.

The application of Yield Management enhances the capacity utilisation whereby fixed costs per unit are brought down to the feasible minimum, Thus, fulfilling the objectives of Marginal Costing. Obviously, Yield Management is an extension of the techniques of Cost Volume Profit Analysis of Marginal Costing.

Yield Competencies

According to Professor Peter Bell, Richard C. Ivey School of Business, "Revenue management concepts will be applied to almost everything that will be sold and will prove to be such a powerful competitive weapon that major firms will be living, and in many cases dying, according to revenue management algorithms."

As part of ongoing changes in the industry, companies throughout the world spectrum are placing a strong emphasis on implementing major operational changes. Beyond recognizing that, meaningful cost reductions must be achieved without compromising safety, capacity and service levels, they are also looking at reducing costs by increasing flexibility and improving asset utilization through Yield Management strategy. In doing so, they continue to reassess their true core competencies that lead to optimize business efficiencies and increase profitability.

Yield Competency matrix may be drawn by finding answers to the following six simple questions that govern the specific features of Yield Management.

1. Is the unit of product or service governed by the principle of **Fixed Capacity**?
2. Is the unit of product or service **Perishable**?
3. Does the product or service warrant **Low Marginal Costs**?

4. Is the unit of product or service prone to **Price Elastic Demand**?
5. Is the unit of product or service poised for a **Segmented Market**?
6. Can the unit of product or service be offered by means of **Advance Booking**?

If the answers are “Yes”, it is time to tread towards the path of Yield Management and catch the train of Revenue Maximisation.

As the Yield Management, being software driven application, its scope can be unending. The path is open for a plethora of Indian SMEs encompassing Transportation, Hospitality, Logistics, Education, Power Distribution, etc. A seat in a bus, a table in a restaurant, some space in a warehouse, a seat in a college, power for farmers, flat in a rental apartment - everything is amenable to YM! It is for the Cost Managers to search out, evolve and implement the strategy of Yield Management across ‘Make in India’.

If customer is the King, Yield Management is the Strategy!

Case Study 1: Wal-Mart pulls off its growth through Price Perfection

Many retailers are trying to replicate the success of Wal-Mart Stores Inc., the world’s largest retailer that was founded over 60 years ago, on “Everyday Low” prices. The central goal of Wal-Mart is to keep retail prices low -- and the company has been very successful at this. Experts estimate that Wal-Mart saves shoppers at least 15 percent on a typical cart of groceries.

Wal-Mart has grown, over the years, into more than just the world’s largest retailer. It is an economic force and a cultural phenomenon. It all started with a simple philosophy from founder Sam Walton: “Offer shoppers lower prices than they get anywhere else”. That basic strategy has shaped Wal-Mart’s culture and driven the company’s growth.

Sam Walton opened his first ‘five-and-dime’ in 1950 and his vision was to keep prices as low as possible. Even if his margins weren’t as fat as competitors, he figured he could make up for that in volume. Wal-Mart has been able to keep its prices low through cutting-edge technology, a push to make suppliers sell merchandise at cheaper and cheaper prices, and a frugal corporate culture.

Wal-Mart pushed the retail industry to establish the universal bar code, which forced manufacturers to adopt common labelling. Over a decade back, Wal-Mart became the first major retailer to demand manufacturers use Radio Frequency Identification Technology (RFID).

The stories of how Wal-Mart pushes manufacturers into selling the same product at lower and lower prices are legendary. One example is Lakewood Engineering & Manufacturing Co. in Chicago, a fan manufacturer. In the early 1990s, a 20-inch box fan costs \$20. Wal-Mart pushed the manufacturer to lower the price, and Lakewood responded by automating the production process. Lakewood also badgered its own suppliers to knock down the prices of parts. Then, in 2000, Lakewood opened a factory in China, where workers could be as cheap as 25 cents an hour. By 2003, the price on the fan in a Wal-Mart store had dropped to about \$10.

In a 2003 Los Angeles Times article, part of a Pulitzer Prize-winning series about Wal-Mart, tells of a Wal-Mart buyer named Celia Clancy, who was in charge of clothing and demanded that each supplier either lower the price or increase the quality every year on every item. This philosophy is known as “plus one.” In “The Wal-Mart Effect,” author Charles Fishman discusses how the price of a four-pack of GE light bulbs decreased from \$2.19 to 88 cents during a five-year period.

Wal-Mart’s impact extends beyond just small suppliers. It also affects how even major, established companies like Coca-Cola and PepsiCo do business. At Wal-Mart’s request, Coke and its largest bottler Coca-Cola Enterprises announced that they are changing the way they deliver Powerade in the United States, altering a basic distribution

method for drinks that has been in place for more than a century. Coke also now allows Wal-Mart in on the research-and-development process. In 2005, Coke planned to launch one new diet cola called Coke Zero. At Wal-Mart's request, it changed the name to Diet Coke with Splenda and launched a separate product called Coke Zero. This kind of retailer involvement was unheard of at Coke decades ago. Pepsi also came up with a line of diet drinks, called Slice One, to initially be sold exclusively in Wal-Mart.

Walton continued to drive an old pickup truck and share budget-hotel rooms with colleagues on business trips, even after Wal-Mart made him very rich. He demanded that his employees also keep expenses to a bare minimum -- a mentality that is still at the heart of Wal-Mart culture. The company has continued to grow rapidly even after his death in 1992 and now operates many retail divisions.

Now that Wal-Mart is so huge, it has unprecedented power to shape labour markets globally and change the way entire industries operate. Ninety percent of the U.S. population is stated to be living within 15 miles of a Wal-Mart, according to "The Wal-Mart Effect."

The key learning could be that Wal-Mart considers 'Everyday Low Prices' are the prices that would be afforded by its customers which in turn would enable customer retention and customer attraction whereby the revenues are propped up. In the process Wal-Mart pulls off its voluminous growth, through perfecting 'Everyday Low Prices' revealing that Price Perfection enables Perpetual Growth.

Case Study 2: McDonald's Cost Leadership Strategy

The restaurant industry is known for yielding low margins that can make it difficult to compete with a cost leadership marketing strategy. However, McDonald's - the near-eighty-year-old restaurant chain - has been extremely successful with Cost Leadership Strategy by offering basic fast-food meals at low prices.

McDonald's has made itself to be the family friendly low-cost restaurant in the fast-food business all over the world. McDonald's have stuck to their core market throughout the years even through the changing times. The term happy meal is said and begged for by children worldwide and has become a house hold name. McDonald's does things differently than its competitors by marketing to the exclusive family market.

The entity realizes that when a customer goes into McDonald's he or she expects two things. They expect the food will come out fast, and it will be inexpensive. That is what McDonald's aim, i.e.. (a) cheap and (b) fast, and everything they do within the organization works towards these specific goals.

These two competitive advantages, cheap and fast, comply directly with the vision of the company which reads: "McDonald's vision is to be the world's best quick service restaurant experience. Being the best means providing outstanding quality, service, cleanliness, and value, so that we make every customer in every restaurant smile."

McDonald's strive to be cost leaders and offer their food at prices that cannot be matched by their competitors. They ensure that their chain-stores are efficient enough to keep everyday operations costs as low as possible.

They have the most modern and technologically advanced equipment in their restaurants to make the processes easier. The computer operated machinery allows the franchisee outlets to keep costs low by needing only a few employees to do the work of several. The automation also enables the employees to do the job quicker. Many of the McDonald's have dual drive-through to decrease wait time and to increase volume of customers served.

In order to ensure that the products remain value oriented, McDonald's make sure costs do not get out of hand, with practices such as wage controls and ingredient standardization. While the fast-food industry experiences a high-turnover rate, McDonald's have learned to work with the system. They make the trade-off of an advanced training program, with that of a simplified, pictographic, "assembly line" procedure, which ensures quality and consistency by narrowing employees' task scope, and therefore their required training. Such of these internal trade-off practices have allowed McDonald's to beat out cost competition effectively.

All of the activities of McDonald's work towards cutting costs. Instead of buying high grade meat and ingredients, McDonald's settle for a standard grade meat that fits exactly into their needs. Also, they keep employee wages low, and training costs minimal. They are able to keep wages low through a division of labour that allows it to hire and train inexperienced employees rather than trained cooks. It also relies on a few numbers of managers who typically earn higher wages. These two characteristics, viz. low-cost materials and low wages, go a long way in keeping McDonald's food cheaper than many of its competitors.

Another important competitive advantage they aim at McDonald's is the speedy delivery of the food. In order to maintain this advantage over other fast-food chains, the processes of cooking food are made simple for all employees at the restaurants. They target a low failure rate to ensure the quick production and delivery of food. The speedy service fits well throughout McDonald's organization and is very convenient to the customer. They built on this idea of convenience by building a McDonald's store everywhere.

History and prestige give McDonald's an advantage against other chains. Prices have remained low due to their enormous wealth's ability to take a hit on price margins and the international expansion making up for the declining U.S. sales. The numerous stores also satisfy consumers on convenience. Being in the industry for so long has allowed McDonald's to lock in certain suppliers at beneficial prices.

McDonald's are, thus, able to maintain their edge on cost leadership through a meticulously systematised cost management activities comprising:

- a. Process Automation & Simplification
- b. Standardisation of Ingredients
- c. Achieving lower Employee Costs
- d. Chain of Convenient Stores
- e. Low price margins driving High Volumes

The synergic impact of McDonald's Cost Leadership is that of maintaining its position as one of the Multinational Industry Leaders.

Case Study 3: Apple earns its pie through Product Differentiation

Apple Inc. is an American multinational corporation headquartered in Cupertino, California. The company designs, develops, and sells consumer electronics, computer software, online services, and personal computers. Its best-known hardware products are the Mac line of computers, the iPod media player, the iPhone smartphone, etc. Apple is the world's second-largest information technology company by revenue after Samsung Electronics, and the world's third-largest mobile phone maker.

The markets for the Apple's products and services are highly competitive and the Company is confronted by aggressive competition in all areas of its business. These markets are characterized by frequent product introductions and rapid technological advances. Principal competitive factors important to the Company include price, product features, relative performance, product quality and reliability, design innovation, software and peripherals, marketing and distribution capability, service and support, and corporate reputation.

The Company's business strategy, therefore, leverages on its unique ability to design and develop its own operating systems, hardware, application software, and services to provide its customers new products and solutions with superior ease-of-use, seamless integration, and innovative design.

Apple became the most valuable consumer-facing brand in the world In June 2011. Apple Inc. reported that the company sold 51 million iPhones in the Q1 of 2014 (an all-time quarterly record), compared to 47.8 million in the year-ago quarter. Apple also sold 26 million iPads during the quarter, also an all-time quarterly record, compared

to 22.9 million in the year-ago quarter. The Company sold 4.8 million Macs, compared to 4.1 million in the year-ago quarter.

Apple's high level of brand loyalty is considered unusual for any product. Fortune magazine named Apple the most admired company in the United States in 2008, and in the world from 2008 to 2012. On September 30, 2013, Apple surpassed Coco-Cola to become the world's most valuable brand in the Omnicom Group's "Best Global Brands" report. Boston Consulting Group has ranked Apple as the world's most innovative brand for a number of years since 2005.

Apple attempts to increase market demand for its products through differentiation, which entails making its products unique and attractive to consumers. The company's products have always been designed to be ahead of the curve compared to its peers. Despite high competition, Apple has succeeded in creating demand for its products, giving the company power over prices through product differentiation, innovative advertising, ensured brand loyalty, and hype around the launch of new products. By focusing on customers willing to pay more and maintaining a premium price at the cost of unit volume, Apple also set up an artificial entry barrier to competitors.

The renowned Steve Jobs is stated to have built the strategy for Apple on four pillars, viz.

1. Offer a small number of products
2. Focus on the high-end
3. Give priority to profits over market share
4. Create a halo effect that makes people starve for new Apple products

Jobs' vision for Apple was always to create a premier product and charge a premium price. Apple's cheapest products are usually priced in the mid-range, but they ensure a high-quality user experience with their features.

Drawing an example from the mobile market, as in May 2015 Apple charges ₹46,000 for its iPhone6 whereas Galaxy S5 mini a compatible product of Samsung is priced at ₹21,000. Apple is able to collect a premium of 119% for its carefully carved out characteristic of unique Product Differentiation.

The reading is that carefully carved out Product Differentiation holds the key for the success story of Apple Inc.; Thus, Apple earns its pie through the strategy of Product Differentiation.

Case Study 4: Yield Management in Indian Railways

Rail vs Air: Captain Gopinath dreamt of bringing air travel within the reach of the common man and conceived Air Deccan which became the first low-cost airline to fly pan-India in 2003. Air Deccan took to the strategy of Yield Management and gradually pioneered the concept of low-cost travel. Air travel was offered at peanut prices as low as one rupee per ticket. The market was taken by storm, and air travel was perceived as an affordable comfort. By 2006 Air Deccan was perceived to have converted air travel into a mass commodity and Thus, changed the face of aviation sector in India. For the first time, train travellers started shifting from rail journey to flight journey.

It was in 2006 that Indian Railways decided to introduce a Dynamic Pricing Policy for freight as well as passenger, for peak and non-peak seasons, premium and non-premium services, and for busy and non-busy routes. As per this policy the rates for non-peak season, non-premium service and empty flow directions would be less than the general rates and the rates for peak season and premium services could be higher than normal. For the freight the non-peak season would be 1st July to 31st October. For the passenger segment this period would be 15th January to 15th April and 15th July to 15th September.

The tricky issue in dynamic pricing is to figure out how high the tariff can go and to what extent a passenger will pay higher rail tariffs, given that one can get an air-ticket at around the same price. A smart-pricing formula had been developed to compete with airways and increase fares as per the demand curve. The formula has a floor price

equivalent or more than the Tatkal Rajdhani/Mail tariff. The price will further increase in tune with the demand curve – the rate at which the tickets are booked. The prices of air tickets at that time will be monitored and Thus, keep the ticket price for premium trains lower than airfares.

The revenue managers of Indian Railways had perceived the market threat posed by the low-cost air carriers to the rail traffic in a proper perspective and have gone forward in adopting the technique of yield management to optimise its capacity utilisation and counter the switchovers.

Reservation Against Cancellation (RAC): As a corollary to its governmental and social obligations, Indian Railway earmarks considerable portion of its accommodations towards various categories of passengers such as Government Exigencies, Defence, Foreign Tourist, Specially Abled, Women, Senior Citizens, etc. The quota is kept open till the last moment and the unfilled seats and berths are allotted to accommodate the passengers from the general wait list. However, the risk of some of the seats and births remaining vacant would always remain. Similarly, last minute cancellations and no shows add up to the idle berths and seats.

The concept of Reservation Against Cancellation (RAC) was evolved with a view to fill up vacant berths and seats that go idle due to passenger cancellations, quota vacancies, no shows, etc. Each train is given a fixed number of RAC allocations by splitting some of the berths into seats. RAC passengers are offered confirmed sitting accommodation with the assurance of providing berths against probable vacancies arising from any sort of quota lapses or cancellations. The system facilitates assured accommodation to the travellers while, at the same time, yielding additional earnings to the Railways. RAC is a practical example of programmed overbooking towards enabling better capacity utilisation.

Auto Up-gradation: In case of upper-class seats remaining vacant, lower-class passengers are upgraded to higher class travel whereby more lower-class vacancies can be offered to waitlisted passengers. It is reported that on the average there are two upgrades for every wait listed upgraded confirmation. Impliedly, whenever an upgrade does happen, then at least two passengers are happy, viz. the one who is upgraded to the higher class and as also the one who is confirmed in the lower class. The process of auto up-gradation, certainly, maximises the passenger capacity utilisation. In addition, this is one measure that had generated a lot of good will and proved to be a brand builder for the Indian Railways.

Tatkal: Tatkal is an example of demand driven differential pricing wherein the last-minute passengers are offered tickets at a premium. Tatkal bookings start a day before the scheduled journey. The tatkal charges are levied as a percentage of the basic fare, i.e., at the rate of 10% for second class and 30% for all other classes, subject to certain minimum and maximum limits. No refunds are granted on cancellation of confirmed tatkal tickets. The tatkal scheme has gained popularity amongst the rail travellers, eventually leading to Premium Tatkal. Premium Tatkal is an advancement of tatkal wherein dynamic pricing has been introduced by increasing the fare for the subsequent bookings.

Premium special train are being run by Indian Railways with dynamic fare pricing, where dynamic fare stands for the fare component that may be increased with the subsequent bookings. Advance Reservation Period (ARP) of this train will be a maximum of 15 days. Only E-tickets will be permitted for booking. No concession shall be applicable in this train. Vacant berths left at the time of charting will be offered for current booking at current booking counters of train originating stations. Cancellation is not allowed.

Slack Season: Towards addressing the supply driven constraints, Indian Railways have implemented the concept of differential pricing by offering lower train fares during the non-peak travel periods. The slack season fares are kept marginally lower than the normal, the objective being to attract more customers for the rail travel, and thereby minimise capacity losses.

Clone Trains: Clone trains are run on high-demand routes within an hour of a scheduled train's departure to accommodate those on its waiting list. The idea behind such real-time demand-driven trains is to ensure that the

wait listed passengers reach their destination around the same time they had originally envisaged. A premium train would automatically get announced on the net/ on the system whenever waitlisted passengers went up beyond a point - one way or both ways. The passengers would have to pay a 'premium' if they want to avail of it.

Add On Revenue: Add On Revenue (AOR) is the Revenue generated by any of the idle resources. Post Budget 2016-17, Indian Railways has initiated several measures to make use of its idle resources and double up its revenues from non-tariff during the next five years. The spread of the activities, spelt out by the railway minister in his budget speech, included:

- i. Monetization of land and buildings through commercial exploitation of vacant land and space rights over station buildings;
- ii. Leasing out huge tracks of land available adjacent to rail network to promote horticulture and tree plantation; Exploring the possibility of using this track for generating solar energy;
- iii. Monetizing data, software and some of the free services provided by IR such as PNR enquiry, currently being commercially exploited by other players;
- iv. Exploiting advertising potential of stations, trains and land adjacent to tracks outside of big stations with a focused target of increasing the advertising revenues by more than four times the current level;
- v. Liberalizing the current parcel policies including opening the sector to container train operators to effect a quantum jump in IR's share of the national CEP (Courier, Express and Parcel) market; and
- vi. Augmentation of revenues from manufacturing activity

Such of these Add On Revenue initiatives do focus on enhancing the existing avenues by putting the idle and dormant resources to demand oriented utilisation in line with the market trend. The propositions are quite innovative and appealing. They would certainly shore up the revenues substantially when implemented.

Surge Pricing: Surge Pricing is the latest adoption of Indian Railways. Rajdhani Express models introduced in 1985, Durontos of 2010 and Shatabdis of the present day - all of them can be construed as demand driven & need warranted premium trains. Effective from 9th September 2016, i.e., exactly ten years after the introduction of dynamic pricing, IR has gone for Surge Pricing on an experimental basis. Ticket prices of Rajdhani, Duronto and Shatabdi trains will keep increasing by ten percent of the basic fare with every ten percent of the tickets sold. The fares will keep raising progressively as the tickets are sold out. Of course, the surging is subject to maximum ceiling.

Being a Social Enterprise, Indian Railways do adopt the concept of 'cap' on fares for each class of travel. A sleeper fare would only increase to one and a half times its base fare and then remain constant; and so also for other classes. Pricing is linked to the rate of sale of tickets, read in buckets, and capped to a maximum for each class of travel.

Overnight Tangle: Wherever the train travel is overnight such that by many a Rajdhani or Duronto, for example Mumbai to Delhi, full travel cost is the key factor that impacts the choice of the mode of journey of a regular passenger. Full cost, here, implies the travel cost and the hoteling cost added together. The traveller starts from home the previous evening, reaches the destination early in the morning, checks into a hotel for the daily chores, completes the day's work, vacates the hotel, takes the evening train and is home the next day morning.

In case of air, the traveller can start from home in the morning, catch the flight in the early hours, attend to the work during the day, board a return flight in the evening and be home by night. The journey having been started from and to home on the same day, the air traveller does not have to incur any hoteling cost. Therefore, an air traveller would opt for train travel only if the to & fro train fare and hoteling cost put together are less than the to & fro air fare.

If a train traveller is extended the facility of having a bath and resting for an hour in an exclusive room in the railway station on marginal rents, Rajdhani and Durontos can pose fierce competition to the airlines. Designated special rest rooms at the Railway Stations can make huge difference to the Class Travel being offered by the IR. The challenging equation, however, is “To & Fro Train Fare + Rest Room Tariff” should be less than “To & Fro Air Fare”. This is an idea that can be toyed with by the railways in a true perspective.

Learning Track: The capacity for every train trip remains fixed; once the train is scheduled the seats and berths acquire the nature of perishability; trip based marginal costs are practically nil; the demand for travel can be influenced by the pricing mechanism; passenger market is segmented with different categories of travellers; and the facility of advance booking exists. All the major features of yield management are, thus, visible in the Indian Railway Model.

General wait list for the reserved accommodation is an age-old tradition of the Indian Railways and reflects a chance overbooking whereas RAC is a programmed overbooking, both the measures being in the direction of augmenting the passenger capacity utilisation. Differential pricing strategy is put to use by IR through the medium of demand driven tatkal and real time-based clone trains. Both of these measures are premium revenue propellers. Auto up-gradation and lower fares during slack season are aimed at improving the capacity utilisation and generating marginal revenues. Non fare revenue is a movement towards next best utilisation of the idle resources. Surge Pricing is a market prone approach.

The endeavours are good, but it is still a long journey for the Indian Railways because of its social and economic limitations. These are the endeavours that can provide the Indian Railways a competitive posture towards perfecting affordable passenger fares and compatible goods tariff; These are the endeavours that shall be pursued for effective and efficient implementation; and these are the endeavours that can make Indian Railways a role model Cost Leader. In the entire process, Yield Management could be the cutting edge for the Indian Railways.

Example 1

A review, made by the top management of Sweat and Struggle Ltd. which makes only one product, of the result of the first quarter of the year revealed the following:

Sales in units	10,000
Loss	₹ 10,000
Fixed cost (for the year ₹1,20,000)	₹ 30,000
Variable cost per unit	₹ 8.00

The Finance Manager who feels perturbed suggests that the company should at least break-even in the second quarter with a drive for increased sales. Towards this, the company should introduce better packing which will increase the cost by ₹0.50 per unit.

The Sales Manager has an alternative proposal. For the second quarter additional sales promotion expenses can be increased to the extent of ₹5,000 and a profit of ₹ 5,000 can be aimed at during the period with increased sales.

The Production Manager feels otherwise. To improve the demand, the selling price per unit has to be reduced by 3%. As a result the sales volume can be increased to attain a profit level of ₹ 4,000 for the quarter.

The Manager Director asks you as a Cost Accountant to evaluate the three proposals and calculate the additional sales volume that would be required in each case, in order to help him to take a decision.

Solution:**Calculation of selling price**

		(₹)
Variable cost	(8 × 10,000)	80,000.00
Add : Fixed cost		30,000.00
Total cost		1,10,000.00
Profit		(10,000.00)
Sales		1,00,000.00
Selling price	(100000/10000)	₹ 10

Statement showing evaluation of alternatives and the number of units required to attain the targets of respective managers.

	Finance Manager	Sales Manager	Production Manager
i) Selling price (₹)	10.00	10.00	9.70
ii) Variable cost (₹)	8.50	8.00	8.00
iii) Contribution per unit (₹)	1.50	2.00	1.70
iv) Fixed cost (₹)	30,000.00	35,000.00	30,000.00
v) Target (₹)	B.E.P	Profit or ₹ 5000	Profit of ₹ 4000
	(30000/1.5)	(40000/2)	(34000/1.7)
	20,000.00	20,000.00	20,000.00
Additional units required	10,000.00	10,000.00	10,000.00

Example 2

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

	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

	Core making	Melting and Pouring	Moulding	Cleaning and Grinding
	18,000	26,000	9,000	6,500
Labour and O.H. rate per direct labour hour	9.00	6.50	6.00	5.2

Operation 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 work's Manager at this Juncture, welcomes an order for 90,000 casting, each weighing about 40 lbs., 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 occupied, he does not want to lose the order and is ready to recommended a quotation on a no-profit and no-loss basis.

Materials required would cost ₹ 1 per casting after deducting scrap credits. The direct labour hour 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 overheads 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 factory overheads 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:

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

Solution:

Computation of labour and overhead rate.

	Core making	Melting & pouring	Moulding	Cleaning & grinding
Labour & overheads (₹)	18,000.00	26,000.00	9,000.00	6,500.00
Labour & overheads per hour (₹)	9.00	6.50	6.00	5.20
No. of hours	2,000.00	4,000.00	1,500.00	1,250.00

Variable overhead per hour (₹)	1.50	0.25	0.67	0.80
Labour rate per hour (₹)	5.00	4.00	4.00	3.60
Hours required for new order	1,350.00	2,250.00	900.00	900.00
Labour cost required for order (₹)	6,750.00	9,000.00	3,600.00	3,240.00
Variable overhead cost for order (₹)	1,620.00	563.00	600.00	270.00

Revised monthly labour and overheads cost budget reflecting the additions of the order

	Core making	Melting & pouring	Moulding	Cleaning & grinding	Total
	₹	₹	₹	₹	₹
Labour	10,000.00	16,000.00	6,000.00	4,500.00	
Labour for the order	6,750.00	9,000.00	3,600.00	3,240.00	
	16,750.00	25,000.00	9,600.00	7,740.00	
Variable overheads	3,000.00	1,000.00	1,000.00	1,000.00	
Variable overheads for the order	1,620.00	563.00	600.00	270.00	
	4,620.00	1,563.00	1,600.00	1,270.00	
Fixed cost	5,000.00	9,000.00	2,000.00	1,000.00	
Total	26,370.00	35,563.00	13,200.00	10,010.00	85,143.00
Add : additional fixed cost					1,000.00
				Total:	86,143.00

Computation of total price for the order

		₹
Material	(15000 × 1)	15,000.00
Labour & overheads	(86143 - 59500)	26,643.00
		41,643.00
Total price for the order	(41643 × 6)	249,858

Transfer Pricing

3.3

Transfer Price (TP) is the notional value of goods and services transferred from one division to the other division of an organisation. In other words, when internal exchange of goods and services take place between the different divisions of a firm, they have to be expressed in monetary terms. The monetary amount for those interdivisional exchanges is called as 'Transfer Price'. Transfer price is, thus, the price that one segment (sub unit, department, division etc.,) of an organization charges for a product or services supplied to another segment of the same organization.

Transfer prices are used when individual entities of a larger multi entity firm are treated and measured as separately run entities. The determination of transfer prices is an extremely difficult and delicate task as lot of complicated issues are involved in the same. Inter division conflicts are also possible.

'Transfer Pricing' is needed to monitor the flow of goods and services among the divisions of a company and to facilitate the divisional performance measurement. The primary utility of transfer pricing is to measure the notional sales of one division to another division. Thus, the system of transfer prices adopted in the organization will have a significant effect on the performance evaluation of various divisions. It becomes very vital when there is internal transfer of goods or services and it is required to appraise the distinct performances of the divisions/ departments involved.

If profit centers are to be used, transfer prices become necessary in order to determine the separate performances of both the 'buying' and 'selling' profit centers. If transfer prices are set too high, the 'selling center' will be favoured. On the other hand, if transfer prices are set too low, the 'buying center' will receive an unwarranted proportion of the profits.

In the current era of globalization, the transfer pricing practice extends to cross-border transactions as well as domestic ones. Multi-National Corporations (MNCs) are legally allowed to use the transfer pricing method for allocating earnings among their various subsidiary and affiliate companies that are part of the parent organization. However, companies at times can also use this practice for planning their taxable income and reducing their overall taxes. The transfer pricing mechanism is a way that companies can shift tax liabilities to low-cost tax jurisdictions. The tax impact of transfer pricing on tax liabilities can be explained by means of the example that follows.

Let's say that an automobile manufacturer has two divisions: Division A, which manufactures software, and Division B, which manufactures cars. Division A sells the software to other carmakers as well as its parent company. Division B pays Division A for the software, typically at the prevailing market price that Division A charges other carmakers. Let's say that Division A decides to charge a lower price to Division B instead of using the market price. As a result, Division A's revenues get reduced and profits dip correspondingly. On the other hand, Division B's costs of goods sold become lower and increase its profits. In short, Division A's revenues and profits are lower by the same amount as of Division B's reduction in costs and hence, there is no financial impact on the company as a whole.

Assuming that Division A is located in a high-tax country and Division B in a low-tax country, the company can save on taxes by making Division A less profitable and Division B more profitable. By making Division A charge lower prices and passing on the savings to Division B, the tax liability of A is reduced. As Division B will be taxed at a lower rate, there would be consequential reduction in the overall tax-outflow and the company would be able to bring down its overall tax liability. In short, by charging below or above the market price, companies can use transfer pricing to transfer profits and costs to other divisions internally and reduce their overall tax burden.

Methods of Transfer Pricing

There are several methods of fixation of 'Transfer Price' some of which are mentioned below:

- i. Pricing based on Cost: In these methods, "cost" is the base and following methods fall under this category
 - a. Actual cost
 - b. Cost Plus
 - c. Standard Cost
 - d. Marginal Cost
- ii. Market price as transfer price: Under this method, transfer price will be determined according to the prevailing market price
- iii. Negotiated pricing: Under this method, the transfer prices are fixed through negotiations between the selling and buying divisions.
- iv. Pricing based on opportunity cost: This pricing recognizes the minimum price that the selling division is ready to accept and the maximum price that the buying division is ready to pay.

The benefits of Transfer Pricing Policy may be listed as under:

- i. Divisional performance evaluation is made easier.
- ii. It will develop healthy inter-divisional competitive spirit.
- iii. Management by exception is possible.
- iv. It helps in co-ordination of divisional objectives in achieving organizational goals.
- v. It provides useful information to the top management in making policy decisions like expansion, sub-contracting, closing down of a division, make or buy decisions, etc.,
- vi. Transfer Price will act as a check on supplier's prices.
- vii. It fosters economic entity and free enterprise system.
- viii. It optimizes the allocation of company's financial resources based on the relative performance of various profit centres, which in turn, are influenced by transfer pricing policies.
- ix. Transfer pricing plays a vital role in strategic tax planning too. In that, the transfer pricing mechanism provides a means whereby companies can shift tax liabilities to low-cost tax jurisdictions and gain cost advantages.

The benefits and advantages of transfer pricing can be understood and appreciated better while going through the illustrative examples furnished hereafter.

Illustration 17

Your company fixes the inter-divisional transfer prices for its products on the basis of cost, plus a return on investment in the division. The Budget for Division A for 2023-24 appears as under:

Particulars	(₹)
Fixed Assets	5,00,000
Current assets	3,00,000
Debtors	2,00,000
Annual Fixed Cost of the Division	8,00,000
Variable Cost per unit of Product	10
Budgeted Volume	4,00,000 units per year
Desired ROI	28%

Determine the transfer price for Division A.

Solution:

Budgeted Volume	= 4,00,000 units per year	
Variable Cost per Unit		= ₹10.00
Fixed Cost per Unit	= (8,00,000 ÷ 4,00,000)	= ₹2.00
Total Assets	= 5,00,000 + 3,00,000 + 2,00,000	
Desired ROI per Unit	= {(10,00,000 × 28%) ÷ 4,00,000}	= ₹0.70
Transfer Price per Unit	= (VC + FC + ROI) = 10.00 + 2.00 + 0.70	= ₹12.70

(Explanatory Comment: The problem facilitates understanding the basic concept of transfer pricing.)

Illustration 18

Transferor Ltd. has two processes, Preparing and Finishing. The normal output per week is 7,500 units (Completed) at a capacity of 75%. Transferee Ltd. had production problems in preparing and requires 2,000 units per week of prepared material for their finishing processes. The existing cost structure of one prepared unit of Transferor Ltd. at existing capacity is as follows:

Material	= ₹ 2.00 (variable 100%)
Labour	= ₹2.00 (Variable 50%)
Overhead	= ₹4.00 (variable 25%)

The sale price of a completed unit of Transferor Ltd is ₹16 with a profit of ₹4 per unit.

Required:

Construct the effect on the profits of Transferor Ltd., for six months (25 weeks) of supplying units to Transferee Ltd. with the following alternative transfer prices per unit:

- Marginal Cost
- Marginal Cost + 25%
- Marginal Cost + 15% Return on capital (assume capital employed as ₹20 lakhs)

- (iv) Existing Cost
- (v) Existing Cost + a portion of profit on the basis of $\{(Preparing\ cost \div Total\ Cost) \times Unit\ Profit\}$
- (vi) At an agreed market price of ₹8.50.

Assume no increase in fixed cost.

Solution:

Evaluation of the effect of transfer of 2,000 units per week for 25 weeks on profit

Sl.	Alternative	TP (₹)	Effect on Profit (₹)	
			Per Unit (TP – Profit)	For 50,000 units (WN 2)
(i)	Marginal Cost (Working Note 1)	4.00	$(4.00 - 4.00) = 0$	Nil
(ii)	Marginal Cost + 25% (Working Note 3)	$4.00 + 25\% = 5.00$	$(5.00 - 4.00) = 1.00$	$50,000 \times 1 = ₹ 50,000$
(iii)	Marginal Cost + 15% ROI (Working Note 3)	$4.00 + 3.00 = 7.00$	$(7.00 - 4.00) = 3.00$	$50,000 \times 3 = ₹ 1,50,000$
(iv)	Existing Cost (Working Note 1)	8.00	$(8.00 - 4.00) = 4.00$	$50,000 \times 4 = ₹ 2,00,000$
(v)	Existing Cost + Proportionate Profit (Working Note 4)	$8.00 + 2.67 = 10.67$	$(10.67 - 4.00) = 6.67$	$50,000 \times 6.67 = ₹ 3,33,500$
(vi)	Agreed Market Price	8.50	$(8.50 - 4.00) = 4.50$	$50,000 \times 4.50 = ₹ 2,25,000$

Working Note 1

Existing Cost Structure one Prepared Unit of Preparing Unit

Serial	Element	Workings	(₹)
1	Variable (Marginal) Costs		
	(i) Material (100%)		2.00
	(ii) Labour (50%)	$(2.00 \times 50\%)$	1.00
	(iii) Overheads (25%)	$(4.00 \times 25\%)$	1.00
	(iv) Total (i to iii)		4.00
2	Fixed Costs		
	(i) Labour (50%)	$(2.00 \times 50\%)$	1.00
	(ii) Overheads (75%)	$(4.00 \times 75\%)$	3.00
	(iii) Total (i to ii)		4.00
3	Total Preparing Cost (1 + 2)		8.00

Working Note 2

Units to be Transferred in 25 weeks = $25 \times 2,000 = 50,000$

Working Note 3

Capital Employed = ₹20,00,000

ROI per annum @ 15% = $20,00,000 \times 15\% = ₹3,00,000$

ROI for 6 months = $\{(3,00,000 \div 12) \times 6\} = ₹1,50,000$

ROI per Unit = $(1,50,000 \div 50,000) = ₹3.00$

Working Note 4

Sale Price of the Completed Unit = ₹16.00

Profit per Unit – ₹4.00

Cost per Completed Unit = $(16.00 - 4.00) = 12.00$

Proportionate Profit for Prepared Unit = $\{(Preparing\ cost \div Total\ Cost) \times Unit\ Profit\}$
 $= \{(8 \div 12) \times 4\} = ₹2.67$

(Explanatory Comment: The problem highlights different methods of adopting the transfer price within an organisation)

Illustration 19

A Company with two manufacturing divisions is organised on profit centre basis. Division 'A' is the only source for the supply of a component that is used in Division B in the manufacture of a product KLIM. One such part is used in each unit of the product KLIM. As the demand for the product is not steady, Division B can obtain orders for increased quantities only by spending more on sales promotion and by reducing the selling prices. The Manager of Division B has accordingly prepared the following forecast of sales quantities and selling prices.

Sales units per day	Average Selling price per unit of KLIM (₹)
1,000	5.25
2,000	3.98
3,000	3.30
4,000	2.78
5,000	2.40
6,000	2.01

The manufacturing cost of KLIM in Division B is ₹3,750 for first 1,000 units and ₹750 per 1,000 units in excess of 1,000 units. Division A incurs a total cost of ₹1,500 per day for an output to 1,000 components and the total costs will increase by ₹900 per day for every additional 1,000 components manufactured. The Manager of Division A states that the operating results of his Division will be optimised if the transfer price of the component is set at ₹1.20 per unit and he has accordingly set the aforesaid transfer price for his supplies of the component to Division A.

You are required to:

- (a) Prepare a schedule showing the profit at each level of output for Division A and Division B.
- (b) Find the profit of the company as a whole at the output level which
 - (i) Division A's net profit is maximum.
 - (ii) Division B's net profit is maximum.
- (c) If the Company is not organised on profit centre basis, what level of output will be chosen to yield the maximum profit.

Solution:

(a) Profit at each level of output

(i) Statement showing profit of division A

Sale per day (units)	Sale value Units × ₹1.20 (₹)	Cost (₹)	Profit/(loss) (₹)
1000	1200	1500	(300)
2000	2400	2400	-
3000	3600	3300	300
4000	4800	4200	600
5000	6000	5100	900
6000	7200	6000	1200

(ii) Statement showing profit of division B

No of units	Selling Price per Unit	Sales	Transfer Price	Other Manufacturing Cost	Total Cost	Profit / (Loss)
	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
1	2	3	4	5	6	7
Derivation		(1 × 2)			(4 + 5)	(3 – 6)
1000	5.25	5250	1200	3750	4950	300
2000	3.98	7960	2400	4500	6900	1060
3000	3.30	9900	3600	5250	8850	1050
4000	2.78	11120	4800	6000	10800	320
5000	2.40	12000	6000	6750	12750	(750)
6000	2.01	12060	7200	7500	14700	(2640)

(b) (i) Profit of the company at the output level where division A's net profit is maximum

Profit of Division A is maximum, i.e., ₹1,200/- at the output level of 6,000 units

Strategic Cost Management

At the level of 6,000 units:

Profit of Division A = ₹1,200

Profit of Division B = (-) ₹2,640

Profit of the Company = (-) ₹1,440

(b) (ii) Profit of the company at the output level where division B's net profit is maximum

Profit of Division B is maximum, i.e. ₹1,060 at the output level of 2,000 units

At the level of 2,000 units:

Profit of Division A = ₹ Nil

Profit of Division B = ₹1,060

Profit of the Company = ₹1,060

(c) Profit when the company is not organized on profit centre basis

Units	Division A (₹)	Division B (₹)	Total (₹)
1000	(300)	300	—
2000	—	1060	1060
3000	300	1050	1350
4000	600	320	920
5000	900	(750)	150
6000	1200	(2640)	(1440)

Maximum profit of ₹1,350 accrues at the output level of 3000 units which may be chosen.

(Explanatory Comment: The problem throws light as to how to make use of the principles of transfer pricing for profit planning, both internally as also externally)

Illustration 20

Division A is a profit centre which produces three products X, Y and Z. Each product has an external market. The details are as follows:

	X	Y	Z
External market price per unit (₹)	48	46	40
Variable cost of production in division A (₹)	33	24	28
Labour hours required per unit in division A	3	4	2

Product Y can be transferred to Division B, but the maximum quantity that might be required for transfer is 300 units of Y.

	X	Y	Z
The maximum external sales are:	800 units	500 units	300 units

Instead of receiving transfers of Product Y from Division A, Division B could buy similar product in the open market at a slightly cheaper price of ₹45 per unit.

What should the transfer price be for each unit for 300 units of Y, if the total labour hours available in Division A are?

- (a) 3800 hours
(b) 5600 hours.

Solution:

Computation of contribution per labour hour from external sales:

	X	Y	Z
Market price (₹)	48	46	40
Variable cost (₹)	33	24	28
Contribution (₹)	15	22	12
Labour hours required	3	4	2
Contribution per labour hour (₹)	5	5.50	6
Ranking	III	II	I

(a) Computation of transfer price when the capacity is 3800 hours:

Allocation of Hours if the capacity is 3800 labour hours

	X	Y	Z
External Sales (Units)	800	500	300
Labour hours required per Unit	3	4	2
Hours needed for External Sales	2400	2000	600
Allocation of Hours if the capacity is 3800 hours as per ranking	1200 (Bal. fig.)	2000	600

The existing capacity is not sufficient, even, to produce the units to meet the external sales. In order to transfer 300 units of Y, 1200 hours are required in which division A has to give up the production of X [since lowest ranking] to the extent of 1200 hours (1200 hours ÷ 3 labour p.a. = 400 units).

Transfer price for 300 units of Y will, therefore, work out to

Variable Cost of Y (₹ 24) + [{"Contribution loss for X (₹ 5 × 1200 hours = 6,000)} ÷ 300] = 24 + 20 = ₹ 44

(b) Computation of transfer price when the capacity is 5600 labour hours:

Allocation of Hours if the capacity is 5600 hours

	X	Y	Z
External Sales (Units)	800	500	300
Labour hours required per Unit	3	4	2
Hours needed for External Sales	2400	2000	600
Balance of hours (Surplus)		600	

Labour Hours needed for 300 units of Y = $300 \times 4 = 1200$

Surplus Labour Hours Available = $5600 - 5000 = 600$

Short fall in Labour Hours = $1200 - 600 = 600$

The short fall 600 hours may have to be diverted from X resulting in a contribution loss of ₹3,000 ($600 \times ₹5$)

Transfer price for 300 units of Y will, therefore, work out to

Variable Cost of Y (₹24) + [$\{ \text{Contribution loss for X (₹5} \times 600 \text{ hours} = 3,000) \} \div 300] = ₹24 + ₹10 = ₹34$

(Explanatory Comment: The problem is a good example to make use of transfer pricing for optimum utilisation of limited resources.)

Illustration 21

P.H. Ltd. has two manufacturing departments organised into separate profit centres known as the Basic unit and Processing unit. The Basic unit has a production capacity of 4,000 tonnes per month of Chemvax but at present its sales are limited 2,000 tonnes to outside market and 1,200 tonnes to the Processing unit.

The transfer price for the year 2023 was agreed at ₹ 400 per tonne. This price has been fixed in line with the external wholesale trade price on 1st January 2023. However due to heavy competition the Basic unit has been forced to reduce the wholesale trade price to ₹360 per tonne with effect from 1st June, 2023. This price however was not made applicable to the sales made to the Processing unit of the company. The Processing unit applied for revision of the price as applicable to the outside market buyers as from 1st June 2023 but the same was turned down by the basic unit.

The Processing unit refines Chemvax and packs the output known as Colour-X in drums of 50kgs each. The selling price of colour-X is ₹ 40 per drum. The Processing unit has a potential of selling a further quantity of 16,000 drums of colour-X provided the overall price is reduced to ₹32 per drum. In that event it can buy the additional 800 tonnes of Chemvax from the basic unit whose capacity can be fully utilised. The outside market will not however absorb more than the present quantity of 2,000 tonnes. The cost data relevant to the operations are:

	Basic Unit (₹)	Processing Unit (₹)
Raw Materials /tonne	70	Transfer price
Variable Cost /tonne	140	170
Fixed Costs /month	3,00,000	1,20,000

Required:

- (i) Prepare statement showing the estimated profitability for June 2023 for each unit and the company as a whole on the following bases:
- At 80% and 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹400 per tonne.
 - At 80% capacity utilisation of the basic unit at the market price of ₹360 per tonne and the transfer price to the Processing unit of ₹400 per tonne.
 - At 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹360 per tonne.
- (ii) Comment on the effect of the company's transfer pricing policy on the profitability of the Processing Unit.

Solution:

- (a) (i) Statement showing computation of profit at 80% capacity when transfer price is ₹ 400 per tonne:

		Basic unit	Processing unit	Total
Production (Tonnes)		$2000 + 1200 = 3200$	1200	4400
Selling Price per Tonne	(₹)	400	$(₹40 \div 50 \text{ kgs}) \times 1000 = 800$	
Variable Cost per Tonne	(₹)	$70 + 140 = 210$	$400 + 170 = 570$	
Contribution per Tonne	(₹)	$400 - 210 = 190$	$800 - 570 = 230$	
Total contribution	(₹)	6,08,000	2,76,000	8,84,000
Fixed cost	(₹)	3,00,000	1,20,000	4,20,000
Profit	(₹)	3,08,000	1,56,000	4,64,000

- (a) (ii) Statement showing computation of profit at 100% capacity when transfer price is ₹ 400 tonne:

		Basic unit	Processing unit	Total
Production (Tonnes)		$3200 \div 80\% = 4000$	$1200 + 800 = 2000$	6,000
Selling Price per Tonne	(₹)	400	$(₹32 \div 50 \text{ kgs}) \times 1000 = 640$	
Variable Cost per Tonne	(₹)	$70 + 140 = 210$	$400 + 170 = 570$	
Contribution per Tonne	(₹)	$400 - 210 = 190$	$640 - 570 = 70$	
Total contribution	(₹)	7,60,000	1,40,000	9,00,000
Fixed cost	(₹)	3,00,000	1,20,000	4,20,000
Profit	(₹)	4,60,000	20,000	4,80,000

- (b) Computation of profit at 80% capacity utilisation of the basic unit at the market price of ₹360 per tonne and the transfer price to the Processing unit of ₹400 per tonne.

		Basic unit		Processing unit	Total
		Outside sale	Internal transfer		
Capacity (Tonnes)		2000	1200	1200	4400
Selling Price per Tonne	(₹)	360	400	800	
Variable Cost per Tonne	(₹)	210	210	570	
Contribution per unit	(₹)	150	190	230	
Total contribution	(₹)	3,00,000	2,28,000	2,76,000	
Total	(₹)		5,28,000	2,76,000	8,04,000
(iv) Fixed cost	(₹)		3,00,000	1,20,000	4,20,000
(v) Profit	(₹)		2,28,000	1,56,000	3,84,000

- (c) Computation of profit at 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹360 per tonne

		Basic unit	Processing unit	Total
Capacity (Tonnes)		4000	2000	6000
Selling Price per Tonne	(₹)	360	640	
Variable Cost per Tonne	(₹)	210	360 + 170 = 530	
Contribution per unit	(₹)	150	110	
Total contribution	(₹)	6,00,000	2,20,000	8,20,000
Fixed cost	(₹)	3,00,000	1,20,000	4,20,000
Profit	(₹)	3,00,000	1,00,000	4,00,000

(d) Comments

Overall profit is more i.e., ₹4,80,000, at 100% capacity of basic unit with a transfer price of ₹400 per ton being the market price. If individual interests are not considered this may be adopted. However, from the view point of the processing unit, it will not be interested to buy more than 1200 tonnes from the basic unit, because its profit gets reduced when it takes additional units.

(Explanatory Comment: The aspects of capacity utilisation and profit planning are two dimensions that are worth learning from the problem)

Illustration 22

SV Ltd. manufactures a product which is obtained basically from a series of mixing operations. The finished product is packaged in the company made glass bottles and packed in attractive cartons. The company is organized

into two independent divisions viz. one for the manufacture of the end product and the other for the manufacture of glass bottles. The Product manufacturing division can buy all the bottle requirements from the bottle manufacturing division.

The General Manager of the bottle manufacturing division has obtained the following quotations from the outside manufacturers for the empty bottles.

Volume	Purchase Value
Empty bottles	Total (₹)
8,00,000	14,00,000
12,00,000	20,00,00

A cost analysis of the bottle manufacturing division for the manufacture of empty bottles reveals the following production costs:

Volume	Purchase Value
Empty bottles	Total (₹)
8,00,000	10,40,000
12,00,000	14,40,000

The production cost and sales value of the end product marketed by the product manufacturing division are as under.

Volume	Total cost of end product*	Sales Value
(Bottle of end product)		(Packed in bottles)
8,00,000	₹ 64,80,000	₹ 91,20,000
12,00,000	₹ 96,80,000	₹ 1,27,80,000

There has been considerable discussion at the corporate level as to the use of proper price for transfer of empty bottles from the bottle manufacturing division to product manufacturing division. This interest is heightened because a significant portion of the Divisional General Manager's salary is in incentive bonus based on profit centre results. As the corporate management accountant responsible for defining the proper transfer prices for the supply of empty bottles by the bottle manufacturing division to the product manufacturing division, you are required to show for the two levels of volume of 8,00,000 and 12,00,000 bottles, the profitability by using

- i. Market price and
- ii. Shared profit relative to the cost involved basis for the determination of transfer prices.

The profitability position should be furnished separately for the two divisions and the company as a whole under each method. Discuss also the effect of these methods on the profitability of the two divisions.

* (Excluding cost of empty bottles)

Solution:

(i) Profitability on the basis of Market Price

Description	Amount (₹)	Amount (₹)
Output (Units)	8,00,000	12,00,000
1. Bottle manufacturing division		
Sale value to outside market	14,00,000	20,00,000
Cost	10,40,000	14,40,000
Profit of Bottle mfg. Div	3,60,000	5,60,000
2. Product manufacturing division		
Sale value	91,20,000	1,27,80,000
Costs :-		
Product manufacturing division	64,80,000	96,80,000
Bottle manufacturing division	14,00,000	20,00,000
Total cost of Product Mfg. Div.	78,80,000	1,16,80,000
Profit of Prod. Mfg. Div.	12,40,000	11,00,000
Total profit of Both Div. (1 + 2)	16,00,000	16,60,000
Transfer Price per Bottle based on Market price	1.75	1.67

(ii) Statement showing Computation of Transfer Price on the basis of Profit shared on Cost Basis:

Description	Amount (₹)	Amount (₹)
Output (Units)	8,00,000	12,00,000
Sales of End Product	91,20,000	1,27,80,000
Production Costs:-		
Product manufacturing division	64,80,000	96,80,000
Bottle manufacturing division	10,40,000	14,40,000
Total Cost	75,20,000	1,11,20,000
Profit	16,00,000	16,60,000
Apportionment of Profit in the ratio of Costs		
Product manufacturing division	13,78,724	14,45,036
Bottle manufacturing division	2,21,276	2,14,964
Total Profit	16,00,000	16,60,000

Description	Amount (₹)	Amount (₹)
Transfer Price of Bottle manufacturing division		
Costs of empty bottle mfg.	10,40,000	14,40,000
Share in Profit	2,21,276	2,14,964
Total Transfer price	12,61,276	16,54,964
Transfer price per bottle	1.5766	1.379

(iii) Statement of Comparative Profits

Description	Amount (₹)	Amount (₹)
Product manufacturing division		
Market Price Basis	12,40,000	11,00,000
Profit shared on Cost Basis	13,78,724	14,45,036
Bottle manufacturing division		
Market Price Basis	3,60,000	5,60,000
Profit shared on Cost Basis	2,21,276	2,14,964

Observations

- Share of Profit of Product manufacturing division is higher when Transfer Price is worked out on Profit shared on Cost Basis.
- Share of Profit of Bottle manufacturing division is higher when Transfer Price is worked out on Market Price Basis.
- Overall Profit of the Company remains the same under both the alternatives.

Illustration 23

XYZ Ltd which has a system of assessment of Divisional Performance on the basis of residual income has two Divisions, Alpha and Beta. Alpha has annual capacity to manufacture 15,00,000 numbers of a special component that it sells to outside customers, but has idle capacity. The budgeted residual income of Beta is ₹ 1,20,00,000 while that of Alpha is ₹1,00,00,000.

Other relevant details extracted from the budget of Alpha for the current year were as follows.

Particulars	
Sale (outside customers)	12,00,000 units @ ₹180 per unit
Variable cost per unit	₹160
Divisional fixed cost	₹80,00,000

Particulars	
Capital employed	₹7,50,00,000
Cost of Capital	12%

Beta has just received a special order for which it requires components similar to the ones made by Alpha. Fully aware of the idle capacity of Alpha, beta has asked Alpha to quote for manufacture and supply of 3,00,000 numbers of the components with a slight modification during final processing. Alpha and Beta agree that this will involve an extra variable cost of ₹5 per unit. Calculate the transfer price which Alpha should quote to Beta to achieve its budgeted residual income.

Solution:

Contribution required at Budgeted Residual Income for Alpha

Fixed cost		80,00,000
Return on Capital Employed (7,50,00,000 × 12 %)		90,00,000
Residual Income of Alpha		1,00,00,000
Total Contribution required (Fixed Cost + Return on Cap. Emp. + Residual Income)		2,70,00,000
Contribution derived from existing units	= 12,00,000 × 20	= ₹ 2,40,00,000
Contribution (Residual) required on 3,00,000 units	= 2,70,00,000 – 2,40,00,000	= ₹ 30,00,000
Contribution per unit	= 30,00,000 ÷ 3,00,000	= ₹ 10
Increase in Variable cost		= ₹ 5
Transfer price = V.C + Desired Residual Contribution + Increase in VC	= 160 + 10 + 5	= ₹175

Illustration 24

XY Co. has Profit Centre Divisions X and Y, making products X and Y respectively. Each unit of Y requires one unit of X and Y can sell a maximum of 50,000 units in the external market at a selling price of ₹150 per unit. X has the capacity to produce 1,00,000 units of X. The variable cost per unit is 12. Fixed costs are ₹7,20,000. X can sell the following quantities in the external market:

Price per unit (₹)	Demand Units
18	84,000
20	76,000
22	70,000
24	64,000
26	54,000 or less

Assume no stock to build up for X or Y.

Y can purchase its requirement from the external market at ₹22 per unit, but has to incur a bulk transportation cost of ₹1,50,000 for any quantity, which will not be incurred on transfers from X.

Required:

- (i) Assuming no demand from Y, what will be the best strategy for X?

- (ii) What will be the minimum transfer price that X will agree to if X has to supply 50,000 units to Y? What price will Y offer as the maximum?
- (iii) If Y is acceptable to partial supplies, what will be X's best strategy under no compulsion to transfer, but with the option to transfer as many units that it wants to? What will be the quantity that X will agree to transfer and the corresponding price, assuming both divisions agree to share the benefits of transfer equally?
- (iv) What is the best strategy of the company? Will the company's overall strategy differ from the individual divisions' strategy? Compute the benefits/disadvantages/indifference between the divisional best and company best strategies.

Present relevant calculations to substantiate all your answers.

Solution:

(i) Assuming no demand from Y, the best strategy for X

Computation of Contribution at different levels of Demand

Demand (Units)	Price (₹ per unit)	Contribution (₹ per unit)	Contribution Value (₹)
84,000	18	6	5,04,000
76,000	20	8	6,08,000
70,000	22	10	7,00,000
64,000	24	12	7,68,000
54,000	26	14	7,56,000

Advise: In the absence of demand from Y, the optimal strategy for X would be to manufacture 64,000 units for external demand whereby it can achieve the maximum contribution of ₹7,68,000.

Working Note: Contribution per unit has been worked out by deducting the variable cost of ₹12 from the respective price.

(ii) X has to supply 50,000 units to Y

If X has to supply 50,000 units to Y, then, it can supply 50,000 units for external sales at ₹26 per unit, the contribution being ₹14 per unit.

Contribution from external sales will be $₹14 \times 50,000 = 7,00,000$

Shortfall in contribution from the maximum level = $7,68,000 - 7,00,000 = 68,000$

Minimum contribution from Y = $68,000 \div 50,000 = ₹1.36$ per unit

Hence, the Minimum Transfer Price = VC of 12 + Contribution of 1.36 = ₹13.36 per unit

However, if X is strong enough, it can demand a price of ₹22 which Y will be paying to outside suppliers.

Y will not pay anything more than its landed cost of ₹25 per unit comprising price of ₹22 + transportation cost of ₹3 ($1,50,000 \div 50,000 = 3$).

(iii) Partial supplies to Y

If X can choose, X will supply 64,000 units for external demand and earn the maximum contribution ₹7,68,000. Balance of 36,000 units can be offered to Y at the variable cost of ₹12.

Y will have to incur bulk transportation cost of ₹1,50,000 even for the balance of 14,000 units it purchases

from outside. Hence it will not pay anything above ₹22. X will not accept anything below ₹12.

Benefits to be shared equally between X and Y = $22 - 12 = 10$ per unit.

Hence, Transfer Price per unit will be $₹12 + 5 = ₹17$, so that Y benefits by ₹5 and X also gets additional contribution of ₹5 per unit transferred. Quantity transferred will be 36,000 units.

(iv) Best strategy of the company

For the company as a whole, Y is incurring a variable cost of ₹22 plus bulk transportation of ₹1,50,000.

Contribution of X as per best strategy = ₹7,68,000

Hence, for the company, best strategy will be to transfer 50,000 units to Y and sell 50,000 units to external sales.

Contribution lost by sub optimal strategy in Div. X = $768000 - (50000 \times 14)$
= ₹68,000

Gain for the Company = $[(50,000 \times 25) - (50,000 \times 12)]$
= $(12,50,000 - 6,00,000) = ₹6,50,000$

Net Gain = $(6,50,000 - 68,000) = ₹5,82,000$

Illustration 25

A company is organized on decentralized lines, with each manufacturing division operating as a separate profit centre. Each division has full authority to decide on sale of the division's output to outsiders and to other divisions.

Division C has always purchased its requirements of a component from Division A. but when informed that Division A was increasing its selling price to ₹150, the manager of Division C decided to look at outside suppliers. Division C can buy the components from an outside supplier for ₹135. But Division A refuses to lower its price in view of its need to maintain its return on the investment. The top management has the following information:

C's annual purchase of the component: 1,000 units

A's variable costs per unit: ₹120

A's fixed cost per unit: ₹20

Required:

- Will the company as a whole benefit, if Division C buys the component at ₹135 from an outside supplier?
- If Division A did not produce the material for Division C, it could use the facilities for other activities resulting in a cash operating savings of ₹18,000. Should Division C then purchase from outside sources?
- Suppose there is no alternative use of Division A's facilities and the market price per unit for the component drops by ₹20. Should Division C now buy from outside?

Solution:

- Division C buying the component at ₹135 from an outside supplier

Purchase cost (from outside supplier) (1,000 units × ₹135p.u.)	1,35,000
Less: Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000
Net loss	15,000

Observation: The company as a whole will incur a loss of ₹15,000 if Division C buys the component from an outside supplier at ₹135 p.u.

(ii) Division C buying the component at ₹135 from an outside supplier and Division A saving ₹18,000

Purchase cost (from outside supplier) (1,000 units x ₹135p.u.)	1,35,000
Less:	
a. Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000
b. Operating savings by using facilities for other activities	18,000
c. Total Savings	1,38,000
Net Gain	3,000

Observation: The company as a whole will benefit by ₹3,000 if Division C buys the component from an outside supplier at ₹135 p.u. and Division A's facilities are used for other activities.

(iii) There is no alternative use of Division A's facilities and the market price per unit for the component drops by ₹20

Purchase cost (from outside supplier) (1,000 units × ₹115 p.u.)	1,15,000
Less: Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000
Net Gain	5,000

Observation: The company as a whole will benefit by ₹5,000 if Division C buys the component from an outside supplier at ₹115 p.u.

Illustration 26

A Company is organized on decentralized lines, with each manufacturing division operating as a separate profit centre. Each Division Manager has full authority to decide on sale of division's output to outsiders or to other divisions. Division A manufactures a single standardized product. Some output is sold externally and remaining is transferred to Division X wherein is a sub-assembly in the manufacture of that Division's product. The unit cost of Division A and Division X is as follows:

Particulars	Division A	Division X
Transfer from Division A to X	-	₹ 42.00
Direct Material	₹6.00	₹ 35.00
Direct Labour	₹3.00	₹4.50
Direct Expenses	₹3.00	-
Variable Manufacturing Overheads	₹3.00	₹18.00
Fixed Manufacturing Overheads	₹6.00	₹18.00

Particulars	Division A	Division X
Variable Selling & Packing Expenses	₹3.00	₹2.50
Total	₹24.00	₹120.00

Division A sold 40,000 units annually at the Standard Price of ₹45 in the external market. In addition to the external sales 10,000 units are transferred annually to Division X at an internal price of ₹42 per unit. Variable Selling and Packing Expenses are not incurred by the Supplying Division for the internal transfer of the product. Division X incorporates the transferred goods into a more advanced product. The Manager of Division X disagrees with the basis used to set the Transfer Price. He argues that Transfer Price should be made at Variable Cost, since he claims that his Division is taking output that Division A should be unable to sell at a price of ₹45. He also submitted a report of the relationship between Selling Price and demand, to support of his disagreement.

The report of customer demand at various Selling Prices for Division A and for Division X is as follows –

Division A	Selling Price per unit	₹30	₹45	₹60
	Demand	60,000 units	40,000 units	20,000 units
Division X	Selling Price per unit	₹120	₹135	₹150
	Demand	15,000 units	10,000 units	5,000 units

The Company has sufficient capacity to meet demand at various Selling Prices. Internal transfer demanded units will be decided by X Division.

Required:

- To calculate Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹42.
- To calculate Divisional and Overall Profitability, if Division A transfers demanded units to X at Variable Cost.
- In place of Internal Transfers, Division A can sell 10,000 units of its product in a new external market without affecting existing market, at a price of ₹32 per unit and X Division can purchase these units at the rate of ₹31 in the open market. Calculate Company's Profit by following the above strategies.

Solution:

Step1: Computation of Variable Costs per unit in different alternatives

SL	Particulars	Division A (for Ext Sale)	Division A (for Int Tfr)	Division X (Own VC)
1	Direct Material (₹)	6.00	6.00	35.00
2	Direct Labour (₹)	3.00	3.00	4.50
3	Direct Expenses (₹)	3.00	3.00	-
4	Variable MOH(₹)	3.00	3.00	18.00
5	Variable S&PE(₹)	3.00	-	2.50
6	Total (1..5) (₹)	18.00	15.00	60.00

Step 2: Computation of Fixed Costs

(i) Division A

Units Produced for External Sales = 40,000

Units Produced for Transfer to X = 10,000

Total Units = (40,000 + 10,000) = 50,000

Fixed Cost = (50,000 units × ₹6) = ₹ 3,00,000

(ii) Division X

Units Produced X = 10,000

Fixed Cost = (10,000 units × 18) = ₹1,80,000

Step 3: Determination of Internal Transfer quantity, i.e., Demanded Units by X Division**a. When Transfer Price is ₹42**

SL	Particulars	5,000 Units	10,000 Units	15,000 Units
1	Selling Price per unit (₹)	150.00	135.00	120.00
2	Variable Cost (₹)			
	Own	60.00	60.00	60.00
	Transfer Price for units from A	42.00	42.00	42.00
	Sub Total	102.00	102.00	102.00
3	Contribution p.u. (1-2)	48.00	33.00	18.00
4	Total Contribution (₹)	2,40,000	3,30,000	2,70,000

Observation: The contribution is maximum (₹ 3,30,000) at 10,000 units and hence

Demanded Units = 10,000 units

b. When Transfer Price is Variable Cost of Division A i.e., ₹15

SL	Particulars	5,000 Units	10,000 Units	15,000 Units
1	Selling Price per unit (₹)	150.00	135.00	120.00
2	Variable Cost (₹)			
	Own	60.00	60.00	60.00
	Transfer Price for units from A	15.00	15.00	15.00
	Sub Total	75.00	75.00	75.00
3	Contribution p.u. (1-2)	75.00	60.00	45.00
4	Total Contribution (₹)	3,75,000	6,00,000	6,75,000

Observation: The contribution is maximum (₹ 6,75,000) at 15,000 units and hence

Demanded Units = 15,000 units

Step 4: Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹42

SL	Particulars	Division A			Division X
		External	Transfer	Total	
1	Number of Units	40,000	10,000	50,000	10,000
2	Selling Price per unit (₹)	45.00	42.00		135.00
3	Variable Cost (₹)				
	Own	18.00	15.00		60.00
	Transfer Price for units from A	-	-		42.00
	Sub Total	18.00	15.00		102.00
4	Contribution p.u. (1-2)	27.00	27.00		33.00
5	Total Contribution (₹)	10,80,000	2,70,000	13,50,000	3,30,000
6	Fixed Costs (₹)			3,00,000	1,80,000
7	Profit (₹)			10,50,000	1,50,000

Profit for the Company = 10,50,000 + 1,50,000 = ₹12,00,000

Step 5: Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹15

SL	Particulars	Division A			Division X
		External	Transfer	Total	
1	Number of Units	40,000	15,000	55,000	15,000
2	Selling Price per unit (₹)	45.00	15.00		120.00
3	Variable Cost (₹)				
	Own	18.00	15.00		60.00
	Transfer Price for units from A	-	-		15.00
	Sub Total	18.00	15.00		75.00
4	Contribution p.u. (1-2)	27.00	-		45.00
5	Total Contribution (₹)	10,80,000	-	10,80,000	6,75,000
6	Fixed Costs (₹)			3,00,000	1,80,000
7	Profit (₹)			7,80,000	4,95,000

Profit for the Company = 7,80,000 + 4,95,000 = ₹12,75,000

Step 6: Divisional Overall Profitability, when Division X procures its materials from external market

SL	Particulars	Division A (External)			Division X
		Existing	Additional	Total	
1	Number of Units	40,000	10,000	50,000	10,000
2	Selling Price per unit (₹)	45.00	32.00		135.00
3	Variable Cost (₹)	18.00	18.00		91.00 (60 + 31)
4	Contribution p.u. (1-2)	27.00	14.00		44.00
5	Total Contribution (₹)	10,80,000	1,40,000	12,20,000	4,40,000
6	Fixed Costs (₹)			3,00,000	1,80,000
7	Profit (₹)			9,20,000	2,60,000

Profit for the Company = 9,20,000 + 2,60,000 = ₹11,80,000

Summary of Overall Profitability

1. Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹42 = ₹12,00,000
2. Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹15 = ₹12,75,000
3. Divisional Overall Profitability, when Division X procures its materials from external market = ₹11,80,000

Relevant Cost Analysis

3.4

Relevant Costs

The costs which should be used for decision making are often referred to as “Relevant Costs”. CIMA defines relevant costs as ‘costs appropriate to aiding the making of specific management decisions’. Relevant costs are costs which are relevant for a specific purpose or situation. In the context of decision making, only those costs are relevant which are pertinent to the decision at hand.

Relevant costs and revenues are those, that are influenced by the decisions. Relevant costs are those expected future costs that are essential but differ for alternative courses of action. It is a future cost that would arise as a direct consequence of the decision under review. The concept of relevant cost is used to eliminate unnecessary data that could complicate the decision-making process.

Relevant Cost Analysis enables managers to choose between alternative choices in situations such as:

- i. Accept or reject an order when there is excess capacity
- ii. Accept or reject an order when there is no excess capacity
- iii. Outsource a product or service
- iv. Add, drop a product, service or department
- v. Sell or process further
- vi. Optimization of limited resources or working under constraint.

Relevant cost analysis is an incremental analysis which considers only relevant costs i.e., the costs that differ between alternatives and ignores sunk costs i.e., costs which have been incurred, which cannot be changed and hence are irrelevant to the situation.

In order to influence a decision a cost must be:

- (a) **Futuristic:** Past costs are irrelevant, as we cannot change them by current decisions and they are common to all alternatives that we may choose.
- (b) **Incremental:** Expenditure which will be incurred or avoided as a result of making a decision. Any costs which would be incurred whether or not the decision is made are not said to be incremental to the decision.
- (c) **Cash flow:** Expenses such as depreciation are not cash flows and are therefore not relevant. Similarly, the book value of existing equipment is irrelevant, but the disposal value is relevant.

Illustration 27

Company A manufactures bicycles. It can produce 1,000 units in a month for a fixed cost of ₹3,00,000 and variable cost of ₹ 500 per unit. Its current demand is 600 units which it sells at ₹1,000 per unit. It is approached by Company B for an order of 200 units at ₹700 per unit. Should the company accept the order?

Solution:

A layman would reject the order because he would think that the order is leading to loss of ₹100 per unit assuming that the total cost per unit is ₹800 (fixed cost of ₹ 3,00,000 ÷ 1,000 = ₹300 and variable cost of ₹500 as compared to revenue of ₹ 700).

On the other hand, a management accountant will go ahead with the order because in his opinion the special order will yield a contribution of ₹200 per unit. He knows that the fixed cost of ₹300,000 is irrelevant because it is going to be incurred regardless of whether the order is accepted or not. Effectively, the additional cost which Company A would have to incur is the variable cost of ₹500 per unit. Hence, the order will yield ₹200 per unit (₹ 700 minus ₹500 of variable cost).

Normally, the following categories of costs are considered as Relevant Costs:

- i. Differential Costs
- ii. Incremental or Marginal Costs
- iii. Opportunity Costs
- iv. Avoidable costs
- v. Replacement Costs
- vi. Imputed Costs
- vii. Out-of-Pocket Costs

(i) Differential Costs: A differential cost is the difference in costs under two or more decision alternatives, specifically, two different projects or situations. It is also the change in the cost due to change in activity from one level to another. Where same item with the same amount appears in all alternatives, it is irrelevant. For example, a plot of land can be used for a shopping mall or entertainment park. The plot is irrelevant since it would be used in both the cases.

An example of differential cost would be of a company which is selling its products through distributors. It is paying them a commission of ₹16 million. Any alternate which costs lesser would be considered. Let us suppose that the company is planning to appoint salespersons to sell its products and cancels the contracts with distributors. In this case, the selling expense is expected to be to ₹12 million. There is cost differential of ₹4 million (16 million - 12million). This is a good sign but the risk would have to be considered for changing the channel of distribution. If there is low risk, it would be prudent to go for own arrangements for sales. Differential costs must be compared to differential revenues. In case, switching over to direct sales brings additional revenues of ₹2 million, it would increase the net benefit to ₹6 million. This would provide more comfort to the decision maker while considering a change in the distribution channel.

(ii) Incremental or Marginal Costs: Incremental or marginal cost is a cost associated with producing an additional unit. In case of a university, it could be cost of admitting another student. Even operating a second shift is an example of incremental cost. It would be noted that the two decisions are not independent as second shift depends upon first shift. Incremental costs must be compared with incremental revenues to arrive at a decision.

(iii) Opportunity Costs: Opportunity cost is the cost of an opportunity of Income or benefits foregone. Opportunity costs represent the potential benefits an individual, investor, or business misses out on when choosing one alternative over another. Because of the fact that opportunity costs are, by definition, unseen, they can be easily overlooked. Understanding the potential of missed opportunities when a business or individual chooses one investment over another allows for better decision-making. In order to properly evaluate opportunity costs, the costs and benefits of every option available must be considered and weighed against the others.

Examples

- a. Mr. Ahmed Shah left a bank job which was paying him ₹ 15,000 per month and got admission in a university. Monthly fee-charge in the university is ₹10,000 per month. For Ahmed Shah, this would mean a cost of ₹25,000 per month (₹ 10,000 + ₹ 15,000).
- b. Farhana is a fresh graduate from a business university. She got two offers, one of ₹ 25,000 from an investment bank and another of ₹ 15,000 for a teaching-assistant in a university. Another of her class-fellow, Shabana got the same offer from the same university. While Shabana would be happy to join the university, Farhana would not be as she would lose an opportunity to serve at the bank for ₹25,000 and if she joins the university, she would incur an opportunity cost of ₹ 10,000.

Whenever an organization is deciding to go for a particular project, it should not ignore opportunities for other projects. It should consider:

1. What alternative opportunities are there?
2. Which is the best of these alternative opportunities?

- (iv) **Avoidable costs:** Avoidable Costs are those which under given conditions of performance efficiency should not have been incurred. These are costs that can be eliminated in whole or in part by choosing one alternative over another.
- (v) **Replacement Costs:** Replacement cost is the cost of replacement at current market price and is relevant for decision-making. It is the cost at which there could be purchase of an asset or material identical to that which is being replaced. Replacement cost is used for determining the optimum time of replacement of an equipment or machine in consideration of maintenance cost of the existing one and its productive capacity.
- (vi) **Imputed Costs:** Imputed costs are hypothetical or notional costs, not involving cash outlay. Imputed costs are computed only for the purpose of decision making. In this respect, imputed costs are similar to opportunity costs. Interest on funds generated internally, payment for which is not actually made is an example of imputed cost. When alternative capital investment projects are being considered out of which one or more are to be financed from internal funds, it is necessary to take into account the imputed interest on own funds before a decision is arrived at.
- (vii) **Out-of-Pocket Costs:** These are costs that entail current or near future cash outlays for the decision at hand. Such costs are relevant for decision - making, as these will occur in near future. This cost concept is a short-run concept and is used in decisions on fixing Selling Price in recession, Make or Buy, etc. Out-of-Pocket costs can be avoided or saved if a particular proposal under consideration is not accepted.

Irrelevant Costs

Irrelevant costs are costs which are not relevant for a specific purpose or situation. The examples of irrelevant costs include:

- i. Sunk Costs
- ii. Committed Costs
- iii. Unavoidable Costs
- iv. Absorbed Costs

- (i) **Sunk Costs:** Sunk costs are historical costs which are incurred i.e., sunk in the past and are not relevant to the particular decision. Sunk costs are those that have been incurred for a project and which will not be recovered if the project is terminated. While considering the replacement of a plant, the depreciated book value of the old asset is irrelevant as the amount is sunk cost which is to be written-off at the time of replacement.

Experiments have been conducted that identify situations in which individuals, including professional managers, incorporate sunk costs in their decisions. One common example from business is that a manager would often continue to support a project that the manager initiated, long after any objective examination of the project seems to indicate that the best course of action is to abandon it. A possible explanation for why managers exhibit this behaviour is that there may be negative repercussions to poor decisions, and the manager might prefer to attempt to make the project look successful, than to admit to a mistake.

Here is another example. Consider a student who is between his/her junior and senior year in college, deciding whether to complete her degree. From a financial point of view (ignoring non-financial factors) her situation is as follows. She has paid for three years of tuition. She can pay for one more year of tuition and earn her degree, or she can drop out of school. If her market value is greater with the degree than without the degree, then her decision should depend on the cost of tuition for next year and the opportunity cost of lost earnings related to one more year of school, on the one hand; and the increased earnings throughout her career that are made possible by having a college degree, on the other hand. In making this comparison, the tuition fee paid for her first three years is a sunk cost, and it is entirely irrelevant to her decision. In fact, consider three individuals who all face this same decision, but one paid ₹ 24,000 for three years of in-state tuition, one paid ₹ 48,000 for out-of-state tuition, and one paid nothing because she had a scholarship for three years. Now assume that the student who paid out-of-state tuition qualifies for in-state tuition for her last year, and the student who had the three-year scholarship now must pay in-state tuition for her last year. Although these three students have paid significantly different amounts for three years of college (₹ 0, ₹ 24,000 and ₹ 48,000), all of those expenditures are sunk and irrelevant, and they all face exactly the same decision with respect to whether to attend one more year to complete their degrees. It would be wrong to reason that the student who paid ₹48,000 should be more likely to stay and finish, than the student who had the scholarship.

- (ii) **Committed Costs:** Committed Costs are costs that will occur in the future, and cannot be changed. Sometimes, accountants use the term “sunk costs” to encompass committed costs as well. A committed cost is an investment that a business entity has already made and cannot recover by any means, as well as obligations already made that the business cannot get out of.

For example, if a company buys a machine for ₹40,000 and also issues a purchase order to pay for a maintenance contract for ₹2,000 in each of the next three years, all of ₹46,000 is a committed cost, because the company has already bought the machine, and has a legal obligation to pay for the maintenance. A multi-year property lease agreement is also a committed cost for the full term of the lease, since it is extremely difficult to terminate a lease agreement.

- (iii) **Unavoidable Costs:** Unavoidable Costs are costs that are inescapable costs, and which are essentially to be incurred, within the limits or norms provided for.
- (iv) **Absorbed Costs:** Absorbed costs are indirect costs that are absorbed by the product or service. Absorbed fixed costs which do not change due to increase or decrease in activity is irrelevant to decision-making. However, if Fixed Costs are specific, they become relevant for decision-making.

Illustration 28

A machine which originally cost ₹12,000 has an estimated life of 10 years and it 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?

Solution:**Computation of relevant cost of using the machine for the order**

Narration	Working	Amount (₹)
Fall in sale value, if used	(8000-7500)	500.00
Incremental maintenance cost	[(60-40) × 2 months]	40.00
Relevant cost of using the machine for the order		540.00

Illustration 29

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:

Materials	Total units required	Units already in stock	Book Value of units in stock	Realisable Value	Replacement Cost
			(₹)/unit	(₹)/unit	(₹)/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 were required for this job, they would need to be replaced to meet other production demand.
- (ii) Materials C and D are in stock as the result of previous excess purchase and they have a 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 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:**Computation of relevant costs of Material**

Material	Relevant Cost	Workings	Amount (₹)
A	Replacement Cost	(1000 × 6)	6,000.00
B	Replacement Cost	(1000 × 5)	5,000.00
C	Realisable Value for 700 units and Replacement Cost for 300 units	[(700 × 2.5) + (300 × 4)]	2,950.00
D	Substitution Cost	(300 × 5)	1,500.00
	Sub Total		15,450.00
	Add: other expenses		550.00
	Total		16,000.00

As the revenue from the order, is more than the relevant costs of ₹ 16,000 the order should be accepted.

Reasoning to accept the relevant cost can be given

- i. **Material A:** Since it is not in stock, needs to be purchased from market at replacement cost, hence it is Relevant
- ii. **Material B:** It is in stock and is being regularly used for other production demand. So it needs to be purchased from market at replacement cost, hence it is Relevant
- iii. **Material C:** partly available Ex stock, so realisable value is relevant and balance needs to be purchased from market at replacement cost, hence it is Relevant
- iv. **Material D:** available ex stock but it can be used for other job where replacement cost is 300 units @ ₹5 each so $300 \times 5 = 1500$ is relevant cost

Illustration 30

Chakra Ltd. manufactures Mixer Grinders. The manufacture involves an assembly of various parts which are processed in the machine shop and purchased components. The on/off switch is presently being purchased from a vendor at ₹4.50 each, annual requirement being 20,000 pieces. The production manager has put up a proposal two months back to make the switch in the machine shop. He had suggested that the company would make profit and save taxes on bought out switch. The costing department was asked to make an estimate of making the item which showed that the cost of making was ₹4.73. The purchase department continues buying the item on the basis of the cost estimate given to them. Recently, the Vendor has sent a letter requesting the purchase department to grant increase in price of 10% minimum per switch as the input costs had gone up. The costing department was once again requested to estimate cost of making the switch. The costing department re-estimated the costs using current prices and observed that the cost of making has gone up to ₹5.33. Purchase department again decided to continue buying as it was cheaper to buy than make.

The cost estimate prepared by the costing department was as under:

	Annual costs	
	Previous (₹)	Current (₹)
Direct Materials	40,000	48,000
Direct Labour	20,000	22,000
Overheads	30,000	31,500
Total cost at current price	90,000	1,01,500
Add: expected increase 5%	4,500	5,075
Expected manufacturing cost	94,500	1,06,575
Cost per price	4.73	5.33

Twenty-five per cent of the overheads are fixed.

Required: Do you agree with the decision of buying considering the relevant costs? If the cost of making or buying is more or less, what factors other than cost will influence making decision?

Solution:

Twenty-five per cent of the overheads are fixed and hence not relevant for decision making.

Fixed Overheads:

Previous = 25% of 30,000 = ₹ 7,500

Current = 25% of 31,500 = ₹ 7,875

Variable Overheads:

Previous = 75% of 30,000 = ₹ 22,500

Current = 75% of 31,500 = ₹ 23,625

Statement of variable costs of making on/off switch before and after price increase

Particulars	Previous (₹)	Current (₹)
Materials	40,000	48,000
Labour	20,000	22,000
Overhead (Variable)	22,500	23,625
Total Variable Cost	82,500	93,625
Number of Units	20,000	20,000
Making Cost per Switch	4.125 (82,500/20,000)	4.68 (93,625/20,000)
Cost of Buying	4.50	4.95 (4.50 × 110/100)

It is not advisable that purchase department continues to buy the switch because variable cost of making is less than the buying cost.

Illustration 31

The Officers' Recreation Club of a large public sector undertaking has a cinema theater 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 theater has been showing the picture 'Blood Bath' for the past two weeks. This picture, which is strictly for adults only has been a great hit and the manager of the theater 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 next two weeks. Even if 'Blood Bath' is extended the theater has to pay the regular rental on 'Appu on the Airbus' as well.

Normal attendance at theater is 2,000 patrons per week, approximately one fourth of whom are children under the age of 12. Attendance of 'Blood Bath' has been 50% greater than the normal total. The manager believes that this would taper off during the second two weeks, 25% below that of the first two weeks, during the third week and 33¹/₃ % 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 theater are shown at a regular price of ₹2 for adults and ₹1.20 for children lower than 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:

Statement showing Evaluation of Alternatives for third and fourth week

Narration		Option 1	Option 2	Option 3
		Blood Bath	Blood Bath & Appu on the Airbus	Appu on the Airbus
		(₹)	(₹)	(₹)
No. of spectators				
Adults:				
Third week	3,000 × 75%	2,250.00	2,250.00	1,500.00
Fourth week	3,000 × 2/3	2,000.00	1,500.00	1,500.00
		4,250.00	3,750.00	3,000.00
Children:				
Third week				500.00
Fourth week			500.00	500.00
			500.00	1,000.00
Total spectators		4,250.00	4,250.00	4,000.00
Revenue				
By sale of tickets				
Adults (Total Spec. × ₹2)		8,500.00	7,500.00	6,000.00
Children (Total Spec. × ₹1.20)		-	600.00	1,200.00
Sub Total		8,500.00	8,100.00	7,200.00
Add: contribution from snacks @ ₹0.48 (40% of 1.20) per Patron		2,040.00	2,040.00	1,920.00
Total Revenue		10,540.00	10,140.00	9,120.00
Less: Incremental Costs (Rental Charges)		1,500.00	900.00	
		9,040.00	9,240.00	9,120.00

It may be observed that the net revenue is more at the option of running 'Blood Bath' and Appu on the Air bus a week each. It must be chosen.

Explanatory Notes:

- (i) The problem specifies that even if 'Blood Bath' is extended the theater has to pay the regular rental of ₹1,200

on ‘Appu on the Airbus’ for the two-week period under consideration and hence they become irrelevant for the decision making.

- (ii) In case of Option 1 rental of ₹1,500 on Blood Bath for two weeks is the incremental cost
- (iii) In case of Option 2 rental of ₹900 on Blood Bath for one week is the incremental cost

Illustration 32

Tiptop Textiles manufactures a wide range of fashion fabrics. The company is considering whether to add a further product ‘Superb’ to the range. A market research survey recently undertaken at a cost of ₹50,000 suggests that demand of the ‘Superb’ will last for only one year, during which 50,000 units could be sold at ₹25 per unit. Production and sale of ‘Superb’ would take place evenly throughout the year. The following information is available regarding the cost of manufacturing ‘Superb’.

Raw Materials: Each ‘Superb’ would require 3 types of raw materials 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 over buying 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	Meters reqd. per unit of Superb	Current Stock	Costs per meter of Raw Material		
			Original Cost	Current Replacement Cost	Current Resale cost
			(₹)	(₹)	(₹)
Posh	1.00	1,00,000	2.10	2.50	1.80
Flash	2.00	60,000	3.30	2.80	1.10
Splash	0.50	0	5.50	5.00	5.00

Labour: Production of each ‘Superb’ would require a quarter of an hour of skilled labour and two hours of unskilled labour @ ₹20 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 ₹1,50,000. 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 which they are earning a contribution surplus of ₹4.50 per labour hour, comprising sales revenue of ₹40.00 less skilled labour wages of ₹30.00 and other variable costs of ₹5.50. It should 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 payable by the company of ₹60,000. 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 for various products. Each MT 4 is replaced as soon 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 were not used to produce 'Superb' it would be sold immediately.

Overheads: A predetermined rate of recovery for overheads 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 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 material, labour overhead etc., substantiating the figures with necessary explanations.

Solution:

For each of the element the relevant cost will be as follows for preparing cost sheet

(i) Market survey cost is a sunk cost and not relevant for decision making

(ii) Raw materials

- (a) Raw material 'Posh', is used regularly and stocks are replenished and hence current replacement cost is relevant.

$$\text{Units of Posh required} = (50,000 \times 1) = 50,000$$

$$\text{Cost of Posh} = (50,000 \times ₹2.5) = ₹1,25,000.00$$

- (b) Current stock of 'Flash' is a result of over buying and will not be used for other than 'Superb' and hence relevant cost is net releasable value.

$$\text{Material required} (50,000 \times 2) = 100,000 \text{ units}$$

$$\text{Cost of Flash} = 60,000 \text{ units from stock @ ₹1.10 per unit and } 40,000 \text{ units @ the replacement cost of ₹2.80 per unit} = (60,000 \times 1.1) + (40,000 \times 2.8)$$

$$= ₹1,78,000$$

- (c) Material 'Splash' has no stock and has to be bought @ the replacement cost of ₹5.00 per unit

$$\text{Units of Splash required} = (50,000 \times 0.5) = 25,000$$

$$\text{Cost of Splash} = (25,000 \times 5.00) = ₹1,25,000.00$$

(iii) Labour:

- (a) Due to unskilled labour, no work has been suffered and so no extra cost and hence not relevant in decision making
- (b) Skilled labour is stated to be scarce. Therefore, not only the cost, but also the contribution forgone, being opportunity cost, should be considered for decision making

Skilled Labour Hours required	= (50,000 × 0.25)	= 12,500
Wages of Skilled Labour @ ₹30 per hour	= (12,500 × 30)	= ₹3,75,000
Contribution foregone @ ₹4.50 per hour	= (12,500 × 4.50)	= ₹56,250.00
Cost of Skilled Labour	= (3,75,000 + 56,250)	= ₹4,31,250

- (c) Effective cost of foremen = (Salary – Pension Deferred)
 = (1,50,000 - 60,000)
 = ₹90,000

(iv) Machinery:

- (a) MT-4 are regularly used and therefore the difference between replacement cost at the start and at the end of the year is relevant

Cost of MT-4 = (80,000 – 65,000) = ₹15,000.00

- (b) MT-7 is not used regularly and the difference between resale value at the start and at the end of the year should be considered as relevant

Cost of MT-7 = (11,000 – 8,000) = ₹3,000.00

(v) Variable Overheads:

Variable Overheads are relevant costs.

Variables Overheads = (50,000 × 1.2) = ₹ 60,000.00

(vi) Fixed Overheads:

Fixed Overheads are not relevant because it is recorded fully at regular production

Cost Sheet of 50,000 units of Superb

Element	Amount (₹)	Amount (₹)
Raw material:		
Posh	125,000.00	
Flash	178,000.00	
Splash	125,000.00	428,000.00
Labour:		
Skilled	4,31,250.00	
Effective cost of Foreman	90,000.00	5,21,250.00
Machinery:		
MT-4	15,000.00	
MT-7	3,000.00	18,000.00
Variable overheads		60,000.00
Total Cost		10,27,250.00
Profit (b/f) [Bal. fig.]		2,22,750.00
Sales (50000 × ₹25)		12,50,000.00

(**Commentary:** The problem serves as a good example for understanding the multiple dimensions of relevant and irrelevant costs)

Illustration 33

A Company can produce any of its 4 products, A, B, C and D. Only one product can be produced in a production period and this has to be determined at the beginning of the production run. The production Capacity is 1,000 hours. Whatever is produced has to be sold and there is no Inventory build-up to be considered beyond the production period. The following information is given:

Particulars	A	B	C	D
Selling Price (₹ Per unit)	40	50	60	70
Variable Cost (₹ Per unit)	30	20	20	30
No. of units that can be sold	1,000	600	900	600
No. of production hours required per unit of product	1 hour	1 hour and 15 minutes	1 hour and 15 minutes	2 hours

What are the Opportunity Costs of A, B, C and D?

Solution:

Serial	Particulars	A	B	C	D
1	Contribution per unit (₹)				
	a. Selling Price	40.00	50.00	60.00	70.00
	b. Variable Cost	30.00	20.00	20.00	30.00
	Contribution (a-b)	10.00	30.00	40.00	40.00
2	Time Required per Unit (Hours)	1.00	1.25	1.25	2.00
3	Production Capacity (Hours)	1000	1000	1000	1000
4	Maximum Production (Units) = $(3 \div 2)$	1000	800	800	500
5	No. of Units that can be sold	1000	600	900	600
6	Sales lost due to production constraint (Units)	Nil	Nil	100	100
7	Opportunity Cost (Contribution lost due to Sales Constraint) = (6×1)	Nil	Nil	₹4000	₹4000

Illustration 34

The accountant of XYZ Ltd. has prepared the following estimate on the basis of which he has advised that a contract should not be accepted at the price offered. The estimate (₹) was as follows:

Material X in stock at original cost	1,50,000
Material Y on order at contract price	1,80,000
Material Z to be ordered at current price	3,00,000

Skilled Labour	5,40,000
Unskilled Labour	3,00,000
Supervisory Cost	1,00,000
General Overheads	1,80,000
Total Cost	17,50,000
Price offered	14,00,000
Net Loss (Price offered – Total Cost)	3,50,000

The following details are available about the cost components listed above.

- Material X is an obsolete material. It can be used on another product W, the material for which is available at ₹1,35,000 (Material X requires some adaptation to be used which costs ₹15,000). It may take some time before W's order is confirmed. Until then storage will cost ₹12,000.
- Material Y is ordered for some other product which is no longer required. It now has a residual value of ₹1,55,000.
- Skilled labour can work on other contracts which are presently operated by semi-skilled labour at a cost of ₹4,00,000
- Unskilled labour are specifically employed for this contract
- Supervisory staff will remain whether or not the contract is accepted. Only two them can replace other positions where the salary is ₹50,000.
- Overheads are charged at $33\frac{1}{3}\%$ of skilled labour. Only ₹1,25,000 would be avoidable

You are required to answer the following questions using relevant cost approach:

- Relevant costs of material X, Y and Z
- Relevant cost of labour-skilled and unskilled
- Relevant cost of Supervisory cost and General overheads
- If the contract is accepted, what would be the resulting financial impact on XYZ's profit

Solution:

(a) Relevant costs of material X, Y and Z

Material X (Obsolete)

Material X in stock at original cost = ₹ 1,50,000

Reuse Value = ₹ 1,35,000

Adaptation Cost = ₹ 15,000

Storage Cost = ₹ 12,000

Relevant Cost of Material X = (1,35,000 – 15,000- 12,000) = ₹ 1,08,000

Material Y (No longer required)

Material Y on order at contract price = ₹ 1,50,000

Residual Value	= ₹ 1,55,000
Relevant Cost of Material Y	= ₹ 1,55,000

Material Z (To be ordered)

Material Z to be ordered at current price	= ₹ 3,00,000
Relevant Cost of Material Z	= ₹ 3,00,000

Material X is an obsolete material but can be used as substitute of some other material available at ₹1,35,000 after incurring an adaptation cost of ₹15,000 and Storage cost of ₹12,000. While using Material 'X' for current work, these costs can be saved, so relevant cost = 1,35,000 - 15,000 - 12,000 = 1,08,000

(b) Relevant cost of labour-skilled and unskilled

Skilled Labour (Can replace unskilled labour)

Cost of skilled labour	= ₹ 5,40,000
Replacement Cost (in place of unskilled labour)	= ₹ 4,00,000
Relevant Cost of Skilled Labour	= ₹ 4,00,000

[Lower of the Above]

Unskilled Labour (Specifically Employed)

Cost of unskilled labour	= ₹ 3,00,000
Relevant Cost of Unskilled Labour	= ₹ 3,00,000

(c) Relevant cost of Supervisory cost and General overheads

Supervisory cost	= ₹ 1,00,000
Replacement Value for others	= ₹ 50,000
Relevant Supervisory Cost	= ₹ 50,000

Avoidable General Overheads	= ₹ 1,25,000
Relevant Costs of General Overheads	= ₹ 1,25,000

(d) Computation of Financial Impact

Serial	Element	Amount (₹)
A	Price Offered	14,00,000
B	Relevant Costs	
	1. Material X	1,08,000
	2. Material Y	1,55,000
	3. Material Z	3,00,000
	4. Skilled Labour	4,00,000

Serial	Element	Amount (₹)
	5. Unskilled Labour	3,00,000
	6. Supervisory Cost	50,000
	7. General Overheads	1,25,000
	8. Total (1...7)	14,38,000
C	Financial Impact (A-B)	(38,000)

Observation: The loss is much less than what the accountant has worked out. However, if the contract is accepted, XYZ's profit will be reduced by ₹ 38,000/-.

Target Costing

3.5

Japan's Competitive Thinking triggers Target Costing

The primary objective of Japanese Management is stated to be linking accounting practices with corporate goals and missions. As a consequence, the Japanese Management Accountants are tuned to focus on influential roles rather than restraining themselves as information providers. There lies the emulative spirit of Japan's Competitive Posture.

The Japanese believe that the key to achieving a competitive edge is simplicity. They have established that there can be too much of good things, too much of a variety, too much of a flexibility and even too much of customer satisfaction. Deriving it from the thought of continuously improving costing, in their stride to maintain the competitive edge, Japanese organisations have moved on to the radical approach being referred to as 'Target costing'. Target costing is market-driven system of cost reduction, focused on managing costs at the developmental and design stages of a product.

In the early of 1990s, three major events occurred in Japan that contributed to significant changes in target costing. The first and the most significant was the bursting of the economic bubble in 1990 and 1991, which caused many companies to struggle to meet customers' expectations of lower prices.

The second event was the rise of the Japanese Yen against the U.S. Dollar, which started in 1993. By 1995, the Japanese Yen had appreciated as much as 50 per cent against the Dollar. It moved from a stabilized exchange rate of 130–140 Yen per Dollar in 1992 onto a record 84 Yen per Dollar in 1995. As a consequence, both the exports and the profit margins of Japanese companies plummeted. The survival instinct of the Japanese companies forced them to intensify their use of target costing.

The long recession in Japan caused by a crisis in the financial sector was the third major event that forced many Japanese companies to squeeze out costs to meet their profitability requirements. Target costing paved the way for survival of the fittest as also to reinvent the upbeat.

The Target Philosophy

Effective cost management systems are developed in response to changing competitive conditions. Target costing is an example of such a system that has a special relevance to companies in the process and assembly industries. In these industries, firms are no longer able to achieve a sustainable competitive advantage by pursuing either a low-cost or differentiation strategy. Rather, firms realize that any competitive advantage they achieve is likely to be short-lived as their competitors move quickly to match new product offerings at competitive prices. Moreover, competitors will often supply their new products with more advanced features, providing further challenges that require a firm to respond.

Rather than attempting to create a sustainable competitive advantage based on either low cost or commanding price premium through product differentiation, firms become involved in continual head-on competition and there arises the need for Target Costing.

Target costing focuses on searching for opportunities for cost reduction at the product planning stage, as well as providing continuous cost reductions once a product commences manufacture. In a competitive economy, product markets influence the determination of the price of the product and the financial markets influence the determination of the cost of capital. Cost of the capital infused by the enterprise sets the benchmark for the quantum of the profit to be achieved. Thus, price of the product as also the quantum of the profit are market driven. The end result is that the product cost boundaries are set by the difference between the price and the profit.

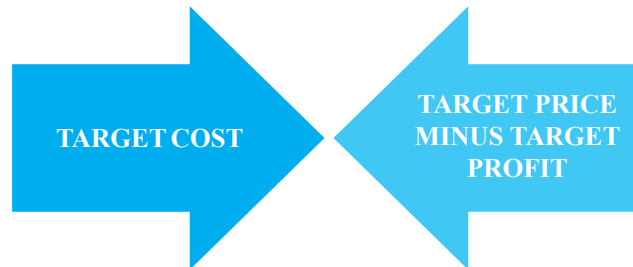


Figure 3.7: Price Led Costing

Target Costing is considered as a philosophy in which product development is based on what the customer wants and is willing to pay for and not what it costs to produce. Hence it starts with the market determined price; then deducts the desired profit margin; and works back the target cost. Peter Drucker calls this “price-led costing.” And that is how the formulation: “Target Cost = Target Price – Target Profit” in place of the traditional approach of “Cost + Profit = Selling Price”.

An illustrative example assumes the following situations. ABC Limited finds a market niche to an innovative kitchen grinder at a market driven price of ₹3,000 per piece. The estimated sales volume at that price would work out to 40,000 pieces per annum aggregating to ₹12 crores. The projected investment towards designing, developing, producing, marketing and servicing these grinders is estimated to be ₹8 crores; and the desired return on investment is 15% per annum. Given the aforesaid data, the target cost to design, develop, produce, market and service the kitchen grinder of ABC Limited may be formulated as shown in the table that follows.

Target Cost of Kitchen Grinder

Serial	Item	Workings	Amount in ₹
1	Projected Sales	40,000 pieces @ ₹3,000 per piece	12,00,00,000
2	Desired Profit	15% ROI on ₹ 8,00,00,000 of Investment	1,20,00,000
3	Target Cost	Projected Sales – Desired Profit	10,80,00,000
4	Target Cost per grinder	Target cost / 40,000 pieces	2,700

The target cost of ₹1080 lakhs per annum which computes to ₹2,700 per grinder would further be broken down function-wise for the designing, developing, producing, marketing, servicing, and so on. Each of the functional areas would be made responsible to achieve the actual costs in line with the targets.

Process of Target Costing

The stages in the process of target costing may be enumerated by means of the following eleven vital steps.

Step1- Identification of the Market Needs: The first step consists of identifying the market requirements as regards design, utility and need for a new product or improvements of existing product. The customer requirements as to the functionality and quality of the product is of prime importance. The design specification of the new product is based on customer's tastes, expectations and requirements. Competitor's products and the need to have extra features over competitor's products are also considered. However, the need to provide improved products, without significant increase in prices, should be recognized as charging a higher price may not be possible in competitive conditions.

Step 2 – Establishment of Selling Price: The second step in target costing is the establishment of a selling price for the new product by adopting market driven approach. The Target Selling Price is determined using various sales forecasting techniques. The price is also influenced by the offers of competitors, product utility, prices, volumes and margins. In view of competition and elasticity of demand, the firm has to forecast the price volume relationship with reasonable certainty. Hence the Target Selling Price is market driven and should encompass a realistic reflection of the competitive environment.

Step 3 - Establishment of Target Production Volumes: Next comes the establishment of Target Production Volumes which is closely related to Target Selling price, given the relationship between price and volume. Target Volumes are also significant in computation of unit costs, in particular, Capacity Related Costs and Fixed Costs. Product Costs are dependent upon the production levels over the life cycle of the product.

Step 4 - Target Profit: The fourth step is that of visualising a target profit by means of investment driven considerations. Since profitability is critical for survival, a Target Profit Margin is established for all new products. The Target Profit Margin is derived from the company's long term business plan, objectives and strategies. Each product or product line is required to earn at least the Target Profit Margin.

Step 5 -Target Cost: The fifth step relates to determining the target cost by subtracting the target profit from the established selling price. The difference between the Target Selling Price and Target Profit Margin indicates the "Allowable Cost" for the product. Ideally, the Allowable Cost becomes the "Target Cost for the product". However, the Target Cost may exceed the Allowable Cost, in the light of the realities associated with existing capacities and capabilities.

Step 6 - Estimating Current Costs: The sixth step relates to estimating the current costs for the product on the basis of functional cost analysis and value engineering of individual components and processes. The estimation of Current Cost is based on existing technologies and components, taking into account the functionalities and quality requirements of the new product. Direct Costs are determined by reference to design specifications, materials prices, labour processing time and wage rates. Indirect Costs may be estimated using Activity Based Costing Principles.

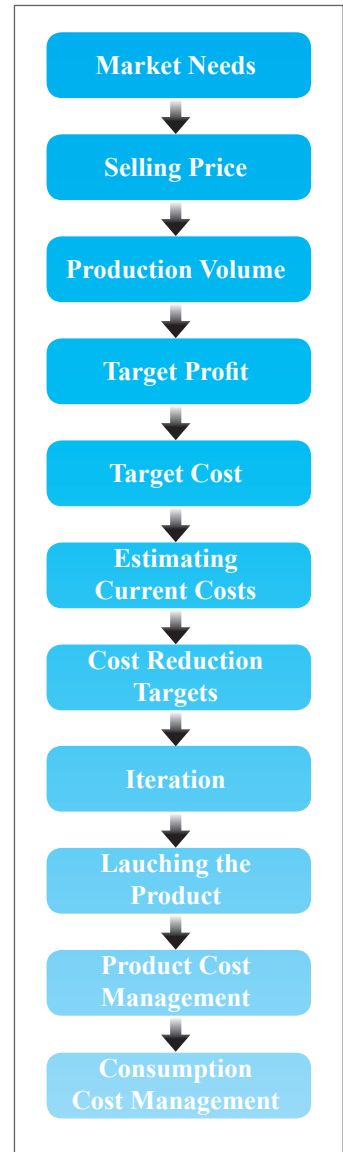


Figure 3.8 : Process of Target Costing

Step 7 - Cost Reduction Targets: Then follows the exercise of comparing the current costs with the target costs. The difference between Current Cost and Target Cost indicates the required cost reduction. This amount may be divided into two constituents namely – (a) Target Cost - Reduction Objective and (b) Strategic Cost - Reduction Challenge. The former is viewed as being achievable (yet still a very challenging target) while the latter acknowledges current inherent limitations. After analyzing the Cost Reduction Objective, a Product-Level Target Cost is set which is the difference between the current cost and the target cost-reduction objective.

Step 8 - Identifying Cost Reduction Opportunities (Iteration): After the Product-Level Target Cost is set, a series of analytical activities, commence to translate the cost challenge into reality. These activities continue from the design stage until the point when the new product goes into production. The total target is broken down into its various components, each component is studied and opportunities for cost reductions are identified. Target, or allowable, costs are identified for individual components or processes and cost improvement teams keep on working to reduce the estimated costs to match the target. However, cost-reduction requirements are not usually applied uniformly across all the components and subsystems of the product, but based on an informed assessment of how much cost can be removed from each component based on value to the customer, historical trends and other data. There may also be a process of negotiation between different production departments and between the company and its suppliers to arrive at final target costs for the individual components. This process of cost reduction is an iterative one which continues until the target cost is reached or it is concluded that the overall target cost cannot be reached and a decision is made not to launch the product.

Step 9 - Launching the Product: The product is on for launching after the cost estimate is on target.

Step 10 - Product Cost Management: Once the target costs have been determined, actual costs can be monitored and managed against the targets using the usual budgeting and costing methods such as standard costing.

Step 11 - Consumption Cost Management: A consumer friendly post sale support service should be oriented towards cost management during the consumption cycle of the product.

Advantages

Target costing offers a range of advantages as follows:

- i. **Innovation:** It reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved.
- ii. **Competitive Advantage:** It enables a firm to achieve competitive advantage over other firms in the industry. The firm which achieves cost reduction targets realistically stands to gain in the long run.
- iii. **Market Driven Management:** It helps to create a Company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.
- iv. **Real Cost Reduction:** It uses management control systems to support and reinforce manufacturing strategies, and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost.

Key Features

Here follow the Seven Key Features that encompass Target Costing.

1. **Price-Led Costing:** Target costing sets the target cost by first determining the price at which a product can be sold in the marketplace. Subtracting the target profit margin from this target price yields the target cost, that is, the cost at which the product must be manufactured. Notice that in a target costing approach, the price is set first, and then the target product cost is determined. This is opposite from the order in which the product cost and selling price are determined under traditional cost-plus pricing.

Key Derivation: Cost = (Price – Profit)

2. **Focus on the Customer:** To be successful at target costing, management must listen to the company's customers. What products do they want? What features are important? How much are they willing to pay for a certain level of product quality? Management needs to aggressively seek customer feedback, and then products must be designed to satisfy customer demand and be sold at a price they are willing to pay. In short, the target costing approach is market driven.

Key Derivation: Customer is the Philosopher

3. **Focus on Product Design:** Design engineering is a key element in target costing. Engineers must design a product from the ground up so that it can be produced at its target cost. This design activity includes specifying the raw materials and components to be used as well as the labour, machinery, and other elements of the production process. In short, a product must be designed for manufacturability.

Key Derivation: Manufacturable Product Design forms the Base

4. **Focus on Process Design:** Every aspect of the production process must be examined to make sure that the product is produced as efficiently as possible. The use of Direct Labour, technology, global sourcing in procurement and every aspect of the production process must be designed with the product's target cost in mind.

Key Derivation: Efficient Process Design is the Pillar

5. **Cross-Functional Teams:** Manufacturing a product at or below its target cost requires the involvement of people from many different functions in an organisation, i.e., market research, sales, design engineering, procurement, production engineering, production scheduling, material handling and cost management. Individuals from all these diverse areas of expertise can make key contributions to the target costing process. Moreover, a cross-functional team is not a set of specialists who contribute their expertise and then leave; they are responsible for the entire product.

Key Derivation: Team Work does the Trick

6. **Life-Cycle Costs:** In specifying a product's target cost, analysts must be careful to incorporate all of the product's life-cycle costs. These include the costs of product planning and concept design, preliminary design, detailed design and testing, production, distribution and customer service. Traditional cost-accounting systems have tended to focus only on the production phase and have not paid enough attention to the product's other life-cycle costs.

Key Derivation: Life Cycle Perception is the Approach

7. **Value-Chain Orientation:** Sometimes the projected cost of a new product is above the target cost. Then efforts are made to eliminate non-value-added costs to bring the projected cost down. In some cases, a close look at the company's entire value chain can help managers identify opportunities for cost reduction.

Key Derivation: Value Addition is the Crux

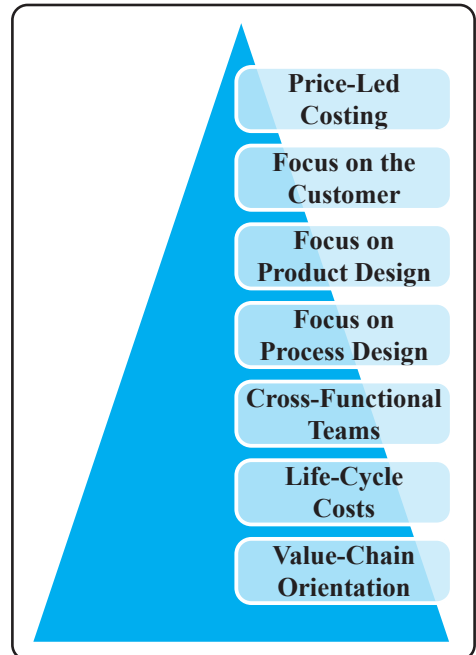


Figure 3.9: Features of Target Costing
technology, global sourcing in procurement and every aspect of the production process must be designed with the product's target cost in mind.

Cost Management Techniques and Target Costing

Many organisations have found that the real strength of target costing lies in its overall framework for cost improvement and efficiency within which a range of different techniques are used. The choice of technique or combination of techniques may vary from one company to another. Important techniques that fit into the framework of target costing include:

- Value Analysis
- Value Engineering
- Just-In-Time (JIT)
- Total Quality Management (TQM)
- Materials Requirements Planning (MRP)
- Kaizen
- Lean Manufacturing
- Activity Based Costing and Management (ABCM)
- Cause-Effect Analysis (Fishbone Diagrams)

Implementation of these techniques, in an overall framework, is a team effort. Given that perspective, target costing paves the way for the cost accounting professionals to look beyond, move onto shop floors and work hand in hand with the cross functional teams.

Target costing is as relevant to the service sector as is for the manufacturing sector. **Cooper and Chew (1996)** identify ways in which target costing can be applied to service-oriented businesses. For process businesses, the focus of target costing shifts from the product to the process, and for service businesses the focus is the service delivery system. All through, the key issues – understanding the needs of the market, customers and users, and ensuring satisfactory financial performance at a given cost or price which does not exceed the target cost – do remain.

Kaizen Costing

One of the most influential changes in the practice of management to emerge is ‘kaizen’ – the philosophy of continuous improvement. Originally a Japanese idea, it has been adapted around the world as an integral part of management strategy. An advancement of the concept of kaizen is that of ‘kaizen costing’ in which the emphasis is on gradual ongoing cost reduction.

Kaizen costing refers to the ongoing continuous improvement program that focuses on the reduction of waste in the production process, thereby further lowering costs below the initial targets specified during the design phase. It is a Japanese term for a number of cost reduction steps that can be used subsequent to issuing a new product design to the factory floor.

Activities in kaizen costing include elimination of waste in production, assembly, and distribution processes, as well as the elimination of unnecessary work steps in any of these areas. Thus, kaizen costing is intended to repeat many of the value engineering steps, continuously and constantly refining the process, thereby eliminating out extra costs at each stage.

Cost reductions resulting from kaizen costing are much smaller than those achieved with value engineering. But these are still significant since competitive pressures are likely to force down the price of a product over time, and any possible cost savings allow a company to still attain its targeted profit margins. Target Costing is considered to be an off spring of Kaizen Costing.

Toyota aggressively pursues kaizen costing to reduce costs in the manufacturing phase. In every July and January, every year plant managers submit six months plan for attaining their kaizen goal. Methods for achieving these goals include cutting material costs per unit and improvement in standard operating procedures. These are pursued based on employees' suggestions. For improvements involving industrial engineering and value engineering, employees often receive support from technical staff. To draw up a kaizen plan after kaizen goals have been set by top management, employees look for ways to contribute to kaizen in their daily work. It was reported that about two million suggestions were received from Toyota employees in one year alone (roughly thirty-five per employee). Ninety-seven per cent of them were adopted. This is a prime example of the concept of employee empowerment in which workers are encouraged to take their own initiatives to improve operations, reduce costs, and improve product quality and customer service.

Case Study 1: Target Costing at Caterpillar

The application of target costing is best illustrated by Dan Swenson, Shahid Ansari, Jan Bell, and IL Woon Kim, in their research article 'Best Practices in Target Costing' (Management Accounting Quarterly, Winter 2003) by drawing a practical example from Caterpillar. The illustration runs as follows.

Caterpillar offers a good illustration to highlight the target costing process as was applied to one of its new products. For this particular vehicle, management set the target cost at 94.6% of a comparable model, creating an initial gap of 5.4%. The cost of the comparable model is based on current manufacturing capabilities. Therefore, to achieve the target, costs must be reduced by 5.4%.

A cost improvement team is then formed comprising representatives from product design, manufacturing engineering, production, marketing, and purchasing to determine how to close the gap. Initially, the group evaluates component part substitutions that would reduce costs but still provide the product features and benefits necessary to satisfy customer requirements. The group also considers opportunities to reduce costs through efficiency improvements. Table 1 shows the outcome from the team evaluations.

Table 1
Modification of Current Product: Known Adjustments

Activity	Current Costs (%)	Projected Costs (%)	Adjusted Savings (%)	Explanation of Known Adjustments
Assembly	5.4	3.9	1.5	Efficiency improvements due to redesigning sheet metal, as documented on current production models.
Cab	7.9	7.1	0.8	Replace current cab with the "Classy Cab." Price Final quote already received.
Engine	8.6	7.9	0.7	Cost estimate from Engineering for switching to different configuration.
Hydraulics	19.1	17.5	1.6	New pump design
Power Train	12.0	12.0	0	
Structures	20.0	20.0	0	
Linkage	18.0	18.0	0	

Activity	Current Costs (%)	Projected Costs (%)	Adjusted Savings (%)	Explanation of Known Adjustments
Others	9.0	9.0	0	
Total	100.0	95.4	4.6	

As may be observed from the table, the cost improvement team identified 4.6% in “known” savings through an initial evaluation of cost savings opportunities. Having reduced the gap by 4.6%, the team must find an additional 0.8% in savings to achieve the 5.4% cost reduction target.

At this stage, the cost improvement team surveys the operational groups, through a questionnaire, to identify potential cost savings opportunities. The responses to the questionnaire do not recommend specific solutions, but they do identify where improvement opportunities are more likely to be successful (see Table 2). Each “yes” response on the questionnaire indicates an opportunity for cost reduction, and the component part category (cab, engine, hydraulics, etc.) that has the largest number of positive responses is viewed as having the greatest potential for saving money.

Table 2
Modification of Current Product: Sample Questionnaire (Yes = 1, No = 0)

	Assembly	Cab	Engine	Hydraulics	Power Train	Structures	Linkage	Others	Total
1. Are there more than five suppliers from whom you can purchase materials?	0	0	0	1	1	1	1	0	
2. Are you costlier than best-in-class supplier (either Caterpillar or non-Caterpillar)?	0	0	0	1	0	0	0	0	
3. Do you plan to survey your supplier cost breakdown?	0	0	0	1	0	0	1	0	
4. Is the current manufacturing process younger than two years?	0	0	0	1	0	0	0	0	
5. Does labour represent more than 40% of your total cost?	0	0	1	1	0	0	1	0	
6. Is your “unit setup cost/total unit cost” ratio greater than 5%?	0	0	1	1	0	0	0	0	
7. Do you see potential for material specification changes?	0	0	0	1	0	0	0	0	
8. Do you see potential for tolerance loosening?	0	0	0	1	0	0	1	0	

	Assembly	Cab	Engine	Hydraulics	Power Train	Structures	Linkage	Others	Total
9. Does the current family of parts contain non-approved parts?	0	0	0	1	0	1	1	0	
10. Can the current design or manufacturing processes be subjected to emerging innovative technologies?	0	0	0	1	0	0	0	0	
Total	0	0	2	10	1	2	5	0	20
Distribution of 0.8% in Cost Reduction (%)	0	0	10	50	5	10	25	0	100

Table 2 highlights a sample questionnaire, and a tally of the responses indicates the extent to which each part category will be targeted for cost reduction. In this case, hydraulics will be responsible for achieving the highest percentage (50%) of the cost savings that are needed. Therefore, the cost of hydraulics must be reduced by 0.4% (0.50×0.08). Table 3 illustrates the final step in the process. It takes the adjusted costs column from Table 1 and subtracts the additional savings that are required for each component part category. The right-hand column in Table 3 illustrates the target cost for the new vehicle, broken down to the component level.

Table 3
Modification of Current Product: Final Target Cost Assignments

Activity	Adjusted Costs (%)	Distribution of 0.8% in Cost Reduction (%)	Target Cost for New Product (%)
Assembly	3.90	0.00	3.90
Cab	7.10	0.00	7.10
Engine	7.90	0.08	7.82
Hydraulics	17.50	0.40	17.10
Power Train	12.00	0.04	11.96
Structures	20.00	0.08	19.92
Linkage	18.00	0.20	17.80
Others	9.00	0.00	9.00
Total	95.40	0.80	94.60

To recap, Caterpillar began with current costs for a comparable product (100%) and, after deducting known savings based on existing technology (Table 1) and potential savings based on an analysis of the questionnaire (Table 2), established cost targets for each component of the new vehicle whereby the target cost is brought down to 94.60% of the current costs.

The researchers observe that target costing is being adopted in some key industries, namely the transportation and heavy equipment industries. Intensive competition, extensive supply chains, and relatively long product

development cycles characterize these industries. The best practice companies were relatively consistent in the way in which they applied target costing. The other companies follow a similar approach to the target costing steps at Caterpillar.

All of the best practice companies employ a cross-functional organizational structure, listen to the “voice of the customer,” emphasize cost reduction during the new product development cycle, and are very effective at removing costs throughout the supply chain. For these companies, target costing has proven to be a very effective means of cost control and profit enhancement.

Case Study 2: Using Target Costing to Increase Value

Here under is an interesting field story on ‘Using Target Costing to Increase Value’ posted in February, 2004, by Brian H. Maskell, President BMA Inc.

The Opportunity: In order to capture an Original Equipment Manufacturing (OEM) business, Major-Cable quoted a very low price and bagged an opportunity. The Target Costing project was designed to improve the profitability of these cables to this customer and other OEM customers.

The Issue: The exercise began with one of the key steps in Target Costing where the customer’s needs were nailed down by specifying them exactly. One need from this customer was to have the cable with a minimum of 20 meters length. This has been a problem for Major Cable because delivery is made from their centralized distribution center which cuts the cable to the customers required length and they cannot always guarantee to have the right quantity of 20-meter lengths. The plant provides the distribution center with much longer lengths, but the specific 20-meter length is difficult to maintain.

The Solution: The initial solution to this problem was for the production plant to create a new product number for 20-meter lengths and manufacturing them specially for the OEM customer. The team then asked the question; “Why does the customer need 20-meter minimum lengths?” It turned out that the machines the customer manufactures require several pieces of cable and the total amount of cable for any machine never exceeds 20 meters. They wanted the cables in 20-meter lengths so that they can issue them to the manufacturing location who in turn can then cut the cables into the lengths they require for the specific machine they are currently manufacturing.

Major Cable’s plant has “off-cuts” of cable that are too short to be sent to the distribution center. These off-cuts are stored as finished goods in case there is occasional demand for a short length; but these off-cuts are mostly scrapped at the year-end. The customer’s need for short lengths interested the production manager. He suggested that instead of supplying the product from the distribution center, they can deliver directly to the customer. Instead of delivering 20-meter lengths, they can deliver the cable cut to the precise lengths required by the customer that day. Instead of supplying the product on large round spools, they can place the cut pieces into production kits in cardboard tubes or boxes to suit the customer’s needs.

After this was discussed and agreed with the customer, the result was:

- The customer is delighted to have just-in-time deliveries of cable kits. This has reduced their manufacturing costs.
- The customer is paying a higher price because they are receiving kits instead of spooled cable.
- Many of the cable lengths can be provided from the off-cuts that were being scrapped most of the time previously. The cost of these pieces is effectively zero.
- The cardboard boxes or tubes are much less expensive than the previously used spools and the overall cost of the packed product has turned out to be less.

The sales people were also delighted. They did not know the production plant could supply cut pieces. They

were under the impression that the production plant would only make long lengths (economic order quantities) on large spools.

The Power of Target Costing: Without Target Costing Major Cable would not have had the opportunity to bring together the cross-functional teams needed to understand the customer's needs and find manufacturing, logistics, and marketing methods to create more value for the customer. In the process, everybody has “won”. The customer has reduced their costs, their inventory, and their production lead time. The production plant has reduced its material costs and scrap. The company's revenues have increased owing to the higher price of the cut piece kits. It is the power of Target Costing in practical action. Put it rightly, it is a focus on increasing value as well as reducing cost.”

Case Study 3: Unveiling the Indian Nano

Talking of the Indian scenario, no other car launch in the history of Indian Auto Industry has received as much global press as the “people's car”, the ‘Tata Nano’. No other car promised to revolutionise motoring as the Nano has. Clever marketing apart, some frugal and out-of-the-box engineering has gone into the making of Nano. Nano modelled Indian Target Costing too.

Much like what Henry Ford had in the beginning of the 20th century with his ‘Model T’ in 1908 at a price of \$825, exactly 100 years after Ratan Tata unveiled Nano, the Indian ultra-low-cost car. At ₹ 1 lakh, the Nano was the world's cheapest car and makes motoring affordable to millions of Indians. Even its deluxe models, featuring air-conditioning and power windows, are fairly cheaper than the then cheapest car in the country, the Maruti 800.

Every component in the Nano is stated to have been studied from a functionality, cost and performance requirements as there was no other way to reduce costs. From an outsourcing perspective, the company put in place an Early Vendor Integration Programme. The company had a lot of design inputs from vendors that either facilitated manufacturing or brought the cost down. This could be for lamps, seats or for any other component.

The Nano is completely indigenised. At the same time over 85 per cent of the Nano is sourced from outside vendors. Vendor parks have been put in place with the objective of ensuring that the components between vendors and the assembly line move smoothly and just in time. Keeping costs down was a major problem for vendors, and they found innovative ways to achieve it. The initial effort was towards cost prevention, which involved selecting a design concept with the least cost. Later on, it is a perpetual cost-reduction effort.

When Ratan Tata addressed an Automotive Component Manufacturers' Association (ACMA) meeting saying that “Can we all get together to produce an Asian peoples' car?”; the response was lukewarm – as in the case of Henry Ford. Tata too encountered considerable amount of ridicule from certain close quarters. Even the vendors took it to be a hypothetical project. But, Ratan Tata didn't budge; he went ahead and did it. The initial idea was to come up with a low-cost car that Malaysia, Indonesia and India could produce jointly. As it turned out, it was left to Ratan Tata to respond to the FT Reporter at Geneva Motor show to commit an Indian Nano at about ₹ 1,00,000. The news got flashed, and it happened. Nano has restructured the dynamics of the car manufacturers all over the world.

As Ratan Tata put it in his interview to the Economic Times in January 2008; “The real challenge is when you have some strength and you really choose to throw out the gauntlet that you can do X and it ought to be the kind of challenge which somebody says that can't be done because then that really becomes the engine of innovation. We haven't said we will send a man to Mars, we may put landers on Mars, but we have not done those kinds of things. It is those areas which really create the innovation that we need”.

Illustration 35

A Company requires ₹ 85,00,000 in sales to meet its target net profit. Its contribution margin is 30% and the fixed costs are ₹15,00,000. What is the target net profit?

Solution:

Sales = ₹85,00,000

Contribution = 30% of Sales = $(85,00,000 \times 30\%) = ₹25,50,000$

Fixed Costs = ₹15,00,000

Target Net Profit = (Contribution – Fixed Costs) = $(25,50,000 - 15,00,000)$
= ₹10,50,000

Illustration 36

Marketing department of an organisation estimates that 40,000 new mixers could be sold annually at a price of ₹6,000 each. To design, develop and produce these new mixers an investment of ₹40,00,00,000 would be required. The company desires a 15% return on investment (ROI). What should be the target cost to manufacture, sell, distribute and service one mixer?

Solution:

Projected sales = $(40,000 \text{ mixers} \times ₹6,000 \text{ per mixer}) = ₹ 24,00,00,000$

Desired profit = $(15\% \text{ of } 40,00,00,000) = ₹6,00,00,000$

Target Cost for 40,000 mixers = Projected Sales – Desired Profit
= $24,00,00,000 - 6,00,00,000$
= ₹18,00,00,000

Target cost per mixer = $(18,00,00,000 \div 40,000 \text{ mixers}) = ₹4,500$

Illustration 37

T Ltd. produces and sells a product. The company expects the following revenues and costs in 2022:

Revenues (400 sets sold @ ₹600 per product) = ₹2,40,000

Variable costs = ₹ 1,60,000

Fixed costs = ₹ 50,000

What amount of sales must T Ltd. has to earn a target net income of ₹63,000 if they have a tax rate of 30%?

Solution:

Sales = ₹2,40,000

Variable Costs = ₹1,60,000

Current Contribution = $(2,40,000 - 1,60,000) = ₹80,000$

Contribution of Sales Ratio = $(80,000 \div 2,40,000) = 1/3$

Target Net Income (Net Profit) = ₹63,000

Tax Rate = 30%

Profit Before Tax = $\{(\text{Net Profit} \div (1 - \text{Tax Rate}))\}$
= $\{63,000 \div (1 - 30\%)\} = ₹90,000$

Fixed Costs + ₹50,000

Target Contribution = (PBT + FC) = 90,000 + 50,000
= ₹1,40,000

Target Sales = (Target Contribution ÷ C/S Ratio)
= (₹1,40,000 ÷ 1/3) = ₹4,20,000

Illustration 38

Desktop Co. manufactures and sells 7,500 units of a product. The full cost per unit is ₹100. The Company has fixed its price so as to earn a 20% return on an Investment of ₹ 9,00,000. What will be the Target selling price?

Solution:

Serial	Particulars	Workings	(₹)
1	Investment	Given	9,00,000
2	Expected Return on Investment	20% of 900000	1,80,000
3	Number of Units	Given	7,500
4	Expected Return on Investment per unit	1,80,000 ÷ 7500	24.00
5	Full cost per unit	Given	100.00
6	Target Selling Price	(24 + 100)	124.00

Illustration 39

'B' manufacturing Company sells its product at ₹1,000 per unit. Due to competition, its competitors are likely to reduce the price by 15%. B wants to respond aggressively by cutting down its price by 20% and expects that the present volume of 1,50,000 units p.a. will increase to 2,00,000 p.a. B wants to earn a 10% target profit on sales. What should be the Target cost per unit of the product?

Solution:

Serial	Particulars	Workings	(₹)
1	Selling Price at Present	Given	1,000.00
2	Proposed Reduction	20% of 1000	200.00
3	Target selling price	(1 – 2)	800.00
4	Target profit margin	10% of 800	80.00
5	Target costs per unit	(3 – 4)	720.00

Illustration 40

You, the manager of a paper mill (XYZ Ltd.), have recently come across a particular type of paper, which is being sold at a substantially lower rate (by another company ABC Ltd.) than the price being charged by your own mill. The value chain for one of MT of such paper for ABC Ltd is follows:

“ABC Ltd. → Merchant → Printer → Customer”.

Strategic Cost Management

ABC Ltd sells this particular paper to the merchant at the rate of ₹30,400 per MT. ABC Ltd pays for the freight which amounts to ₹600 per MT. Average sales returns and allowances amount to 4% of sales and approximately equal to ₹1200 per MT.

The value chain of your company, through which the paper reaches the ultimate customer, is similar to that of ABC Ltd. However, your mill does not sell directly to the merchant. The latter receives the paper from a huge distribution center maintained by your company at Haryana. Shipment costs from the mill to the Distribution Center amount to ₹200 per MT while the operating costs in the Distribution Center have been estimated to be ₹125 per MT. The return on investments required by the Distribution Center for the investments made amount to an estimated ₹ 120 per MT.

You are required to compute the “Mill Manufacturing Target Cost” for this particular paper for your company. You may assume that the return on the investment expected by your company equals ₹ 120 per MT of such paper.

Solution:

Serial	Particulars	Workings	₹ per MT
1	ABC Ltd's selling price to the merchant	Given	30,400
2	Post Sales Expenses	Given	
	Freight paid by ABC Ltd		600
	Normal sales returns and allowances		1,200
	Sub Total		1,800
3	Net Selling Price of ABC Ltd	(1 – 2)	28,600
4	XYZ Ltd's Expected Return on Investment	Given	120
5	Target cost for XYZ Ltd	(3 – 4)	28,480
6	Post Manufacturing Expenses	Given	
	Shipment costs to the Distribution Center		200
	Operating cost in the Distribution Center		125
	Expected Return on Investment of the Distribution Center		120
	Sub Total		445
7	Target manufacturing cost of the Mill	(5 – 6)	28,035

Illustration 41

CELO Company has the capacity of production of 80,000 units and presently sells 20,000 units at ₹100 each. The demand is sensitive to selling price and it has been observed that for every reduction of ₹10 in Selling Price, the demand is doubled.

Required:

- What should be the Target Cost at full capacity, if Profit Margin on Sale is 25%?
- What should be the Cost Reduction Scheme at full capacity if at the present level 40% of the cost is variable and Total Fixed Cost is ₹36 lakhs?
- If Rate of Return desired is 16%, what will be the maximum investment at full capacity?

Solution:**a. Target Cost at Full Capacity****Projected Demand**

Selling Price (₹ Per Unit)	Demand (Units)	Capacity Utilisation
100	20,000	25%
90	$(20,000 \times 2) = 40,000$	50%
80	$(40,000 \times 2) = 80,000$	100%

Selling Price at Full Capacity = ₹80.00

Target Profit = 25% on Sales = ₹20.00

Target Cost at Full Capacity = $(80 - 20) = ₹ 60.00$ per unit

b. Cost Reduction Scheme

(i) Computation of Variable Cost per unit

At the Present Capacity of 20,000 units

Selling Price = ₹100.00 per unit

Profit Margin = 25% on Sales = ₹25.00

Total Cost = $(100 - 25) = ₹ 75.00$

Variable Cost = 40% of total cost = 40% of 75 = ₹30.00

(ii) Existing Projections of Total Cost at full capacity

Total Variable Cost = $(₹30 \times 80000) = ₹24.00$ lakhs

Total Fixed Cost = ₹36.00 Lakhs

Total Cost = $(24.00 + 36.00) = 60.00$ lakhs

(iii) Target Cost = $(60 \times 80000) = 48.00$ lakhs

(iv) Cost Reduction Scheme

Cost Reduction Needed = $(\text{Existing Cost} - \text{Target Cost}) = (60.00 - 48.00) = ₹ 12.00$ lakhs

c. Maximum Investment at full capacity

(i) Target Profit at full Capacity

Sales = $80.00 \times 80,000$ units = ₹64.00 lakhs

Target Cost = ₹48.00 lakhs

Target Profit = $(64.00 - 48.00) = ₹16.00$ lakhs

(ii) Rate of Return on Investment = 16%

(iii) Minimum Investment

Investment Needed = $(\text{Target Profit} \div \text{Target Return on Investment}) = (16.00 \div 16\%) = ₹ 100.00$ lakhs

Illustration 42

K & Co. manufactures and sells 15,000 units of a product. The Full Cost per unit is ₹200. The Company has fixed its price so as to earn a 20% Return on an Investment of ₹18,00,000.

Required:

- (i) Calculate the Selling Price per unit from the above. Also, calculate the Mark-up % on the Full Cost per unit.
- (ii) If the Selling Price as calculated above represents a Mark-up of 40% on Variable cost per unit, calculate the Variable cost per unit.
- (iii) Calculate the Company's Income if it had increased the Selling Price to ₹230. At this price, the company would have sold 13,500 units. Should the Company have increased the Selling price to ₹230?
- (iv) In response to competitive pressures, the Company must reduce the price to ₹210 next year, in order to achieve sales of 15,000 units. The Company also plans to reduce its investment to ₹16,50,000. If a 20% Return on Investment should be maintained, what is the Target Cost per unit for the next year?

Solution:

(i) Target Sale Price per unit

Serial	Particulars	Workings	(₹)
1	Full Cost per unit	Given	200.00
2	Target profit per unit	$(18,00,000 \times 20\%) \div 15,000$ $= 3,60,000 \div 15,000$	24.00
3	Target Sale Price	(Full Cost + Target Profit)	224.00
4	Mark up on Full Cost	$(24 \div 200) \times 100$	12%

(ii) Variable Cost per Unit

Serial	Particulars	Workings	(₹)
1	Selling Price	As computed above	224.00
2	Variable Cost	$(224 \div 140) \times 100$	160.00

Note: Sale price includes 40% of mark up on Variable cost and hence equals to 140% on variable cost.

(iii) Company's income at a Selling Price of ₹230

a. Existing Contribution

Existing Number of Units = 15,000

Selling Price = ₹224.00

Variable Cost = ₹ 160.00

Contribution = $(224 - 160) = ₹64$ per unit or $(64 \times 15,000) = ₹9,60,000$

b. Revised Contribution

Revised Number of Units = 13,500

Revised Selling Price = ₹230.00

Revised Variable Cost = ₹ 160.00

Revised Contribution = $(230-160) = ₹70$ per unit or $(70 \times 13,500) = ₹9,45,000$

c. Observation

Revision of Selling Price from ₹224 to ₹230 brings down the contribution by ₹15,000 i.e., from ₹9,60,000 to ₹9,45,000 and hence is not beneficial.

(iv) Target Cost for Next Year

Serial	Particulars	Workings	(₹)
1	New Sale Price	Given	210.00
2	Target profit per unit	$(16,50,000 \times 20\%) \div 15,000$ units $= 3,30,000 \div 15,000$	22.00
3	Target Cost per unit	(New Sale Price - Target Profit)	188.00

Illustration 43

ABC Enterprises has prepared a draft budget for one of its products for the next year as follows:

Quantity	10,000 units
	(₹)
Sales price per unit	300
Variable costs per unit:	
Direct materials	80
Direct labour (2 hrs × 30)	60
Variable overhead (2 hrs × 5)	10
Contribution per unit	150
Budgeted contribution	15,00,000
Budgeted fixed costs	14,00,000
Budgeted profit	1,00,000

The Board of Directors is dissatisfied with this budget, and asks working party to come up with alternate budget with higher target profit figures.

The working party reports back with the following suggestions that will lead to budgeted profit of ₹2,50,000. The company should spend ₹2,46,000 on advertising, & set the target sales price up to ₹316.75 per unit. It is expected that the sales volume will also rise, in spite of the price rise, to 12,000 units.

In order to achieve the extra production capacity, however, the workforce must be able to reduce the time taken to make each unit of the product. It is proposed to offer a pay and productivity deal in which the wage rate per hour is increased to ₹40. The hourly rate for variable overhead will be unaffected. Ascertain the target labour time required to achieve the target profit.

Solution:**(i) Target Conversion Cost per unit**

Serial	Particulars	Workings	(₹)
1	Target profit	Given	2,50,000
2	Add	Given	
	Fixed cost		14,00,000
	Additional Advertisement		2,46,000
	Sub Total		16,46,000
3	Total contribution	(1 + 2)	18,96,000
4	Sales volume		12,000
5	Contribution per unit	(18,96,000 ÷ 12,000)	158.00
6	Target Selling price per unit	Given	316.75
7	Target variable cost per unit	(6 – 5)	158.75
8	Material cost per unit	Given	80.00
9	Target Conversion Cost per unit (i.e.. Labour + Variable overhead)	(7 – 8)	78.75

(ii) Target Labour Time

Let Target Labour Time per unit be x hours

Revised Labour Rate being ₹40 per hour, Total Labour Cost = 40x

Variable Overhead Rate being ₹5 per hour, Total Variable Cost = 5x

Thus, Total Conversion Cost = 40x + 5x = 45x

We also have Total Conversion Cost = 78.75 × 12,000 units = ₹9,45,000

Therefore, 45x = 9,45,000 or x = 21,000 hours

Target Labour Time per unit = 21,000 ÷ 12,000 = 1.75 hours

Alternative

$$45x = 78.75$$

$$x = 1.75 \text{ hours}$$

(iii) Target Reduction in Labour Time

Budgeted Labour Time per unit = 2.00 hours

Target Labour Time per unit = 1.75 hours

Target Reduction in Labour Time = (2.00 – 1.75) = 0.25 hours per unit

Hence, target labour time per unit, required to achieve the target profit, is 1.75 hours and target reduction in labour time is 0.25 hours per unit.

Illustration 44

The operation costs of a product produced by ABC Ltd are ₹53. Presently, the company produces only 600 units p.a. to sell at ₹55 per unit due to hard competition in the market. But with existing facilities, production can be increased to 1,000 units if additional production can be sold in the market. The company accordingly introduced target costing on market research, new design for the product and changes in the process so that costs are brought down substantially and market share can be increased. The estimates for the next year are:

Target selling price	₹50 per unit
Target profit margin	10% on sales
Target volume	900 units

Required:

- Calculate target costs per unit and target costs for the expected volume; and
- Compare existing profit with target profit.

Solution:**Statement of Target Costs**

Particulars	Per Unit (₹)	For 900 units (₹)
Target selling price	50	45,000
Less: Target profit margin (10% of sales)	5	4,500
Target costs	45	40,500

Comparative Profit Statement

Particulars	Existing Position		Proposed Position	
	Per unit (₹)	600 units (₹)	Per unit (₹)	900 units (₹)
Sales	55	33,000	50	45,000
Less: Costs	53	31,800	45	40,500
Profit	2	1,200	5	4,500

Illustration 45

A manufacturing company “Bee” sells its product at ₹1,000 per unit. Due to competition, its competitors are likely to reduce price by 15%. Bee wants to respond aggressively by cutting price by 20% and expects that the present volume of 1,50,000 units p.a. will increase to 2,00,000. Bee wants to earn a 10% target profit on sales. Based on a detailed value engineering the comparative position is given below:

Particulars	Existing (₹)	Target (₹)
Direct material cost per unit	400	385
Direct manufacturing labour per unit	55	50

Particulars	Existing (₹)	Target (₹)
Direct machinery costs per unit	70	60
Direct manufacturing costs per unit	525	495
Manufacturing overheads :		
No. of orders (₹80 per order)	22,500	21,250
Testing hours (₹2 per hour)	4,500,000	3,000,000
Units reworked (₹100 per unit)	12,000	13,000

Manufacturing overheads are allocated using relevant cost drivers. Other operating costs per unit for the expected volume are estimated as follows:

Research and Design	₹50
Marketing and customer service	₹130
Total	₹180

Required:

1. Calculate target costs per unit and target costs for the proposed volume showing break up of different elements.
2. Prepare target product profitability statement.

Solution:

1. **Calculation of target costs per unit and target costs for the proposed volume showing break up of different elements**

(a) Target Costs per Unit

Target selling price: ₹1,000 less 20%	₹800
Less: Target profit margin (10%)	₹80
Target costs per unit	₹720

(b) Elementwise break-up of ₹720 per unit

Serial	Particulars	₹ Per Unit
1	Direct Manufacturing Costs	
a	Direct materials	385
b	Direct manufacturing labour	50
c	Direct machining costs	60
d	Sub Total (a to c)	495

2	Manufacturing Overheads		
a	Ordering and receiving (21,250 × ₹80) ÷ 2,00,000	8.50	
b	Testing and inspection (30,00,000 × ₹2) ÷ 2,00,000	30.00	
c	Rework (13,000 × ₹100) ÷ 2,00,000	6.50	
d	Sub Total (a to c)		45
3	Total manufacturing costs (1+2)		540
4	Other operating costs		
a	Research and Design	50	
b	Marketing and Customer service	130	
c	Sub Total (a to b)		180
5	Total Cost (3+4)		720

2. Target Product Profitability

Serial	Particulars	Per unit (₹)	2,00,000 units (₹)
1	Sales	800	16,00,00,000
2	Costs of goods sold:		
a	Direct materials	385	7,70,00,000
b	Direct labour	50	1,00,00,000
c	Direct machining costs	60	1,20,00,000
d	Subtotal (a..c)	495	9,90,00,000
3	Manufacturing overheads	45	90,00,000
4	Total manufacturing costs (2+3)	540	10,80,00,000
5	Gross margin (1-4)	260	5,20,00,000
6	Other Operating costs		
a	Research and Design	50	1,00,00,000
b	Marketing and customer service	130	2,60,00,000
b	Sub Total (a..b)	180	3,60,00,000
7	Operating profit (5-6)	80	1,60,00,000

Illustration 46

S Ltd. has sales of 2,00,000 units at a price of ₹100.00 per unit and profit of ₹70.00 Lakhs in the current year. Due to stiff competition, next year the Company has to reduce its price of product @ 3% to achieve same target volume of sales. The cost structure and profit for the current year is given as below:

Particulars	(₹ Lakhs)
Direct Material	50.00
Direct Wages	40.00
Variable Factory Overheads	15.00
Fixed Overheads including Sales & Admin Expenses	25.00
Total Cost	130.00

To achieve the Target Cost to maintain the same profit, the Company is evaluating the proposal to reduce Labour Cost and Fixed Factory Overheads. A Vendor supplying the Machine suitable for the Company's operations has offered an advanced technology Semi-Automatic Machine of ₹10 Lakhs as replacement of Old Machine worth ₹3 Lakhs. The Vendor is agreeable to take back the Old Machine at ₹1 Lakh only. The Company's policy is to charge depreciation at 15% on WDV. The Maintenance Charge of the Existing Machine is ₹1 Lakh per annum whereas there will be warranty of services free of cost for the New Machine first two years. There are 7 Supervisors whose Salary is ₹1.50 Lakhs per annum. The New Machine having Conveyor Belt is expected to help in cost cutting measures in the following ways -

- (1) Improve Productivity of workers by 10%
- (2) Cut-down Material Wastage by 5%
- (3) Elimination of services of Supervisors because of automatic facilities of the machine
- (4) Saving in Packaging Cost by ₹1 Lakhs.

Assuming Cost of Capital to be 15%, calculate how many Supervisors should be removed from the production activities to achieve the Target Cost.

Solution:

A. Targeted Cost Reduction

Targeted price Reduction = 3% of 200 lakhs = ₹6 lakhs

Targeted Cost Reduction = ₹6 lakhs

B. Net Savings on account of New Machine

1. Savings on account of the New Machine

- a. Reduction in wages due to Improve Productivity of workers by 10%
= {40 lakhs - [(40 lakhs ÷ 110) × 100]} = (40.00 - 36.36) = ₹3.64 lakhs
- b. Cut-down Material Wastage by 5% = 5% of 50 lakhs = ₹2.50 lakhs
- c. Saving in Packaging Cost = ₹1.00 lakhs
- d. Saving in Maintenance Cost = ₹1.00 lakhs
- e. Total Savings = 3.64 + 2.50 + 1.00 + 1.00 = ₹8.14 lakhs

2. Additional Costs on account of the New Machine

- a. Loss in Disposal of Old Machine = (₹3 lakhs - ₹1 lakhs) = ₹2.00 lakhs
 - b. Difference in Depreciation = (₹10 lakhs - ₹3 lakhs) × 15% = ₹1.05 lakhs
 - c. Cost of Capital Investment = (₹10 lakhs × 15%) = ₹1.50 lakhs
 - d. Total Additional Costs = (2.00 + 1.05 + 1.50) = ₹4.55 lakhs
3. Net Savings = (8.14 – 4.55) = ₹3.59 lakhs

C. Supervisors to be Removed

Short Fall = (A-B) = (6.00 – 3.59) = ₹2.41 lakhs

Number of Supervisors to be removed

$$= (2.41 \text{ lakhs} \div 1.50 \text{ lakhs per supervisors}) = 1.61$$

i.e.. say 2 Supervisors

Product Life Cycle Costing

3.6

Product Life Cycle

Product Life Cycle is a pattern of expenditure, sale level, revenue and profit over the period beginning from new idea generation to the deletion of product from product range. Product Life Cycle spans the time from initial R&D on a product to when customer servicing and support is no longer offered for the product. For products like motor vehicles, this time-span may range from 5 to 7 years. For some basic pharmaceuticals, the time-span be 7 to 10 years.

Many a product are observed to possess a distinctive life cycle comprising six clearly defined phases, each phase having its own characteristics. Older, long-established products eventually become less popular, while in contrast, the demand for new, more modern goods usually increases quite rapidly after they are launched. The time line commencing from the innovation of a new product and ending with its degeneration into a common product and the eventual extinction is termed as the life cycle of a product.

- (i) **Development Phase:** The cycle begins with the identification of a new consumer need and the invention of a new product. This is often followed by patent protection and further development to make it saleable. Research and engineering skills enable product development. The costs incurred are termed as 'developmental'. No revenues accrue during this phase.
- (ii) **Introduction Phase:** During this phase, the product is introduced to the market. Efforts are towards spreading awareness about the product, the target being achieving market acceptance. Promotional costs will be high, sales revenue low and profits probably negative. The skill that is exhibited in testing and launching the product will rank high in this phase as the critical factor in securing success and initial market acceptance. Sales of new products usually rise slowly at first.
- (iii) **Growth Phase:** As the product gains market acceptance a rapid expansion follows leading to the growth. This phase is characterized by product penetration into the market and increase in sales & profits. Benefits of economies of scale would start pouring in leading to cost reduction. It now becomes vital to secure wholesaler and retailer support as also to ensure consumer satisfaction. If the product is successful, growth usually accelerates at some point, often catching the innovator by surprise.
- (iv) **Maturity phase:** This stage begins after sales cease to rise exponentially indicating market saturation. Eventually most potential customers have tried the product and sales settle at a rate governed by population growth

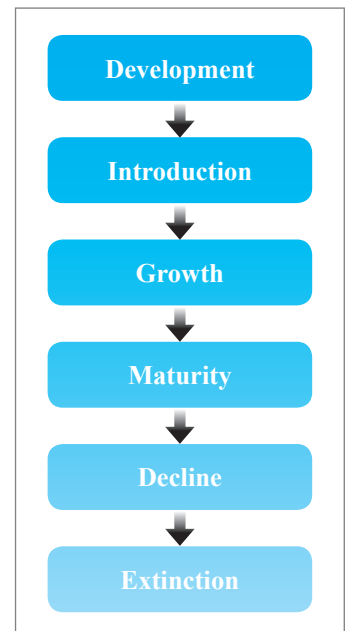


Figure 3.10: Phases of Product Life Cycle

and the replacement rate of satisfied buyers. In addition, there were no new distribution channels to fill. This is usually the longest and the most competitive stage in the cycle. Most of the popular products are in this stage. The period over which sales are maintained depends upon the firm's ability to stretch the cycle by means of market segmentation and finding new uses for it.

- (v) **Decline phase:** Eventually most products and brands enter a period of declining sales. This may be caused by: technical advances leading to product substitution, fashion and changing tastes, exogenous cost factors reducing profitability until it reaches zero at which point the product's life is commercially complete. The speed of degeneration differs from product to product.
- (vi) **Extinction Phase:** This is the tail end of the decline phase where after the product exits from the market.

The Revenue, Cost and Profit Matrix of the Product Life Cycle is summarised in the table that follows.

Revenue, Cost and Profit Matrix of the Product Life Cycle

Serial	Phase	Revenue	Costs	Profit
1	Development	Nil	Developmental	Nil
2	Introduction	Low	Promotional	Negative
3	Growth	Increasing	Declining	Growing
4	Maturity	Stable	Stable	Stable
5	Decline	Declining	Increasing	Declining
6	Extinction	Nil	End Life	Negative

The product can sustain viability only if the total revenue arising from the product during its life cycle exceeds the total costs incurred during all the phases of its life.

Life cycle costing is a system that is evolved to track and accumulate the costs and revenues attributable to a product or service from the stage of development to the stage of extinction. In essence, Life Cycle Costing is a means of estimating all the costs involved in procuring, operating, maintaining and ultimately disposing a product throughout its life. Eventually, the process involves tracing costs and revenues of the product over several calendar periods.

Life cycle costing is a three-staged process. The first stage is life cost planning stage which includes planning LCC Analysis, Selecting and Developing LCC Model, applying LCC Model and finally recording and reviewing the LCC Results. The Second Stage is Life Cost Analysis Preparation Stage followed by the third stage of Implementation and Monitoring Life Cost Analysis.

Characteristic of PLCC

- Involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle.
- Traces research, design and development costs and total magnitude of these costs for each individual product and compared with product revenue.
- Assists report generation for costs and revenues.

Importance of Product Life Cycle Costing

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

- a. **Time based analysis:** Life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their life cycle. Costs and revenues can be analysed by time periods. The total magnitude of costs for each individual product can be reported and compared with product revenues generated in various time periods.
- b. **Overall Cost Analysis:** Production Costs are accounted and recognized by the routine accounting system. However non-production costs like R&D; design; marketing; distribution; customer service etc. are less visible on a product — by — product basis. Product Life Cycle Costing focuses on recognizing both production and non-production costs.
- c. **Pre-production costs analysis:** The development period of R&D and design is long and costly. A high percentage of total product costs maybe incurred before commercial production begin. Hence, the Company needs accurate information on such costs for deciding whether to continue with the R&D or not.
- d. **Effective Pricing Decisions:** Pricing Decisions in order to be effective should include market considerations on one hand and cost considerations on the other. Product Life Cycle Costing and Target Costing help analyze both these considerations and arrive at optimal price decisions.
- e. **Better Decision Making:** Based on a more accurate and realistic assessment of revenues and costs, at least within a particular life cycle stage, better decisions can be taken.
- f. **Long Run Holistic view:** Product Life Cycle Costing can promote long-term rewarding in contrast to short-term profitability rewarding. It provides an overall framework for considering total incremental costs over the entire life span of a product, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- g. **Life Cycle Budgeting:** Life Cycle Budgeting with Target Costing principles, facilitates scope for cost reduction at the design stage itself. Since costs are avoided before they are committed or locked in the Company is benefited.
- h. **Review:** Life Cycle Costing provides scope for analysis of long-term picture of product line profitability, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

The Three Key Factors

Three key factors should be optimised to maximise a product's profitability over its whole life. These are:

- i. Design
 - ii. Time to Market
 - iii. Length of the Lifecycle.
- (i) **Design:** Development activity is the most important from a sustainability perspective. Since 80% of a product's costs are locked in at the design stage, it's vital that waste is minimised by design. Choices made at the design stage should account for all stages of a product's life, including end of life costs, which could involve handling or storing hazardous material, and polluting activities, such as land fill or incineration.

The reduction of waste by design is usually good for profitability and also the sustainable consumption of scarce capitals. While it may be tempting to specify cheap materials in the design of products, consider the

environmental impact and end of life requirements. Even though some financial or environmental costs accumulated in the lifecycle of a product are not producer costs, the producer should still consider these costs carefully. Aware consumers will often factor such costs into their purchase decisions, and Thus, even if the producer ignores these factors, the consumer may calculate the total cost of ownership of the product, not just the initial acquisition cost. Known as asset lifestyle costing, this is the other side of the coin to product lifecycle costing.

A great example is the aero engine market. The balance of power has radically shifted from producers to operators in recent years, to the extent that producers must now guarantee operating performance across a range of factors. They must also agree to pay operators for costs of under-performance over an engine's whole life. Producers are taking note of consumers' increasing environmental awareness. As a result, they're considering the price and financial cost of their products. However, they're also designing products to have a lower environmental impact and using 'environmental friendliness' as a selling point to enhance product appeal. More and more producers are adopting 'triple bottom line', or 'PPP' (people, planet, profit) principles in practice.

- (ii) **Time to Market:** Competitors watch each other to discover new products coming to market, and they seek to develop products to keep ahead of each other. When competition is minimal, the growth phase of a product's life provides producers the chance to charge premium prices and invest heavily in awareness activities. The longer a producer has before a rival product hits the market, the longer they're able to command a price premium and entrench their product in the consumer's buying habits. The management accountant should be aware of the competitive market for new products to improve accuracy of whole-life profitability.
- (iii) **Length of the Lifecycle:** Getting to market quickly will lengthen a product's life. However, there are other ways of increasing a product's life and, ideally, consideration should be given to this at the design stage itself. Examples include:
 - ⦿ Designing the product in a modular way and conceptualising future modules to aid introducing variants after the initial launch
 - ⦿ Designing the product to satisfy as many markets as possible, even if this requires post-launch modification
 - ⦿ Staggering the launch in different markets to reduce costs and prolong demand.

The management accountant should try to encourage teams involved in product conceptualisation to consider as many of these factors as possible at the design phase. This improves estimation of whole-life profitability.

Illustration 47

Wipro is examining the profitability and pricing policies of its Software Division. The Software Division develops Software Packages for Engineers. It has collected data on three of its more recent packages - (a) ECE Package for Electronics and Communication Engineers, (b) CE Package for Computer Engineers, and (c) IE Package for Industrial Engineers. Summary details on each package over their two-year Life Cycle product lives are –

Package	Selling Price	Number of units sold	
	(₹)	Year 1	Year 2
ECE	250	2,000	8,000
CE	300	2,000	3,000
IE	200	5,000	3,000

Assume that no inventory remains on hand at the end of year 2. Wipro is deciding which product lines to

emphasize in its software division. In the past two years, the profitability of this division has been mediocre. Wipro is particularly concerned with the increase in R&D costs in several of its divisions. An analyst at the Software Division pointed out that for one of its most recent packages (IE) major efforts had been made to reduce R&D costs. Last week, Amit, the Software Division Manager, decides to use Life Cycle Costing in his own division. He collects the following Life Cycle Revenue and Cost information for the packages -

Amount (₹)

Particulars	Package ECE		Package CE		Package IE	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Revenues	5,00,000	20,00,000	6,00,000	9,00,000	10,00,000	6,00,000
Costs						
R&D	7,00,000	-	4,50,000	-	2,40,000	-
Design of Product	1,15,000	85,000	1,05,000	15,000	76,000	20,000
Manufacturing	25,000	2,75,000	1,10,000	1,00,000	1,65,000	43,000
Marketing	1,60,000	3,40,000	1,50,000	1,20,000	2,08,000	2,40,000
Distribution	15,000	60,000	24,000	36,000	60,000	36,000
Customer Service	50,000	3,25,000	45,000	1,05,000	2,20,000	3,88,000

Present a Product Life Cycle Income Statement for each Software Package. Which package is most profitable and which is the least profitable? How do the three packages differ in their cost structure (the percentage of total costs in each category)?

Solution:

Life cycle Income Statement (in ₹ '000s)

Particulars	Package ECE				Package CE				Package IE			
	Y1	Y2	Total	%	Y1	Y2	Total	%	Y1	Y2	Total	%
Revenues	500	2,000	2,500	100%	600	900	1,500	100%	1,000	600	1,600	100%
Costs												
R&D	700	-	700	28%	450	-	450	30%	240	-	240	15%
Design	115	85	200	8%	105	15	120	8%	76	20	96	6%
Manufacturing	25	275	300	12%	110	100	210	14%	165	43	208	13%
Marketing	160	340	500	20%	150	120	270	18%	208	240	448	28%
Distribution	15	60	75	3%	24	36	60	4%	60	36	96	6%
Cust. Service	50	325	375	15%	45	105	150	10%	220	388	608	38%
Total Costs	1065	1,085	2150	86%	884	376	1260	84%	969	727	1696	106%
Profit			350				240				(96)	

Observations

- (a) Package ECE with a Life Cycle Profit of ₹3,50,000 is most profitable; while package IE with a Life Cycle Loss of ₹96,000 is least profitable.
- (b) As may be observed from the tabulated data, the differences in comparative percentages (of total costs to revenues) in each category of the three packages are apparent and self-explanatory.

Illustration 48

Zenith Ltd. manufactures tablet batteries. The company is preparing a product life cycle budget for a new type of battery. Development on the new battery is to start shortly. Estimates for the new battery are as follows:

Life cycle units manufactured and sold	2,00,000
Selling price per battery	₹ 55
Life cycle costs:	
R & D and design cost	₹ 8,00,000
Manufacturing:	
Variable cost per battery	₹ 25
Variable cost per batch	₹ 300
Batteries per batch	250
Fixed costs	₹ 12,00,000
Marketing:	
Variable cost per battery	₹ 3.50
Fixed costs	₹ 8,00,000
Distribution:	
Variable cost per batch	₹ 140
Batteries per batch	100
Fixed costs	₹ 4,60,000
Customer service cost per battery (Variable)	₹ 1.70

Ignore the time value of money.

Required:

- (i) Calculate the budgeted life cycle operating income for the new battery.
- (ii) What percentage of the budget total product life cycle costs will be incurred by the end of the R&D and design stages?
- (iii) Company's market research department estimates that reducing price by ₹ 2.50 will increase life cycle unit sales by 8%. If unit sale increases by 8%, the company plans to increase manufacturing and distribution batch sizes by 8% as well. Assume that all variable costs per battery, per batch and fixed costs will remain the same. Should the company reduce battery price by ₹ 2.50?

Show your calculations.

Solution:

(i) Statement of Budgeted Life Cycle Revenue and Costs

(a) Revenue $(2,00,000 \times ₹55) = ₹1,10,00,000$

(b) Costs:

Element	(₹)
Research and design	8,00,000
Manufacturing costs:	
Variable costs $₹(25 \times 200000)$	50,00,000
Batch cost $₹\{300 \times (200000 \div 250)\}$	2,40,000
Fixed cost	12,00,000
Marketing costs:	
Variable costs $₹(3.5 \times 200000)$	7,00,000
Fixed cost	8,00,000
Distribution costs:	
Batch cost $₹\{140 \times (200000 \div 100)\}$	2,80,000
Fixed cost	4,60,000
Customer service [Variable] (1.7×200000)	3,40,000
Total cost	98,20,000

(c) Operating Income = $1,10,00,000 - 98,20,000 = ₹11,80,000$

(ii) Total product life cycle costs by the end of the R&D and design stages

Budgeted product life cycle costs for R&D and design	₹ 8,00,000
Total budgeted life cycle product costs	₹ 98,20,000
Percentage of budgeted product life cycle cost incurred till the R&D and design	$(8,00,000 \div 98,20,000) \times 100 = 8.15\%$

(iii) Statement of Revised Budgeted Life Cycle Revenue and Costs

(a) Revenue $(2,16,000 \times ₹52.50) = ₹1,13,40,000$

(b) Costs

Element	(₹)
Research and design	8,00,000
Manufacturing costs:	
Variable costs $₹(25 \times 216000)$	54,00,000
Batch cost $₹\{300 \times (216000 \div 270)\}$	2,40,000

Element	(₹)
Fixed cost	12,00,000
Marketing costs:	
Variable costs ₹ (3.5 × 216000)	7,56,000
Fixed cost	8,00,000
Distribution costs:	
Batch cost ₹ {140 × (216000 ÷ 108)}	2,80,000
Fixed cost	4,60,000
Customer service [Variable] (1.7 × 216000)	3,67,200
Total cost	1,03,03,200
Operating Income	10,36,800

(c) Operating Income = 1,13,40,000 – 1,03,03,200 = ₹ 10,36,800/-

Suggestion: Since profit is lower, price should not be reduced. (i.e.. ₹ 11,80,000 > ₹ 10,36,800)

Illustration 49

SRM Ltd. has developed a new product 'Kent' which is about to be launched into the market and anticipates to sell 80,000 of these units at a sale price of ₹ 300 over the product's life cycle of four years. Data pertaining to product 'Kent' are as follows:

Costs of Design and Development of Moulding Dies and Other tools	₹ 10,25,000
Manufacturing costs	₹ 125 per unit
Selling costs	₹ 12,500 per year + ₹ 100 per unit
Administration costs	₹ 50,000 per year
Warranty expenses	5 replacement parts per 25 units @ ₹ 10 per part, 1 visit per 500 units (cost ₹ 500 per visit)

Required:

- Compute the product Kent's Life Cycle Cost.
- Suppose SRM Ltd. can increase sales volume by 25% through 15% decrease in selling price, should SRM Ltd. choose the lower price?

Solution:

- Statement showing Kent's Life Cycle Cost (80,000 units)

Particulars	Amount (₹)
Costs of Design and Development of Moulding Dies and Other tools	10,25,000

Particulars	Amount (₹)
Manufacturing costs (125 × 80,000 units)	1,00,00,000
Selling costs (₹ 100 × 80,000 units + ₹ 12,500 × 4 years)	80,50,000
Administration costs (₹ 50,000 × 4 years)	2,00,000
Warranty expenses	
Replacement costs: {(80,000 units ÷ 25 units) × 5 parts × ₹ 10}	1,60,000
Visit costs: {(80,000 units ÷ 500 units × 1 visit × ₹ 500)}	80,000
Total Cost	1,95,15,000

(ii) Statement showing Kent's Life Cycle Cost (1,00,000 units)

Particulars	Amount (₹)
Costs of Design and Development of Moulding Dies and Other tools	10,25,000
Manufacturing costs (125 × 1,00,000 units)	1,25,00,000
Selling costs (₹ 100 × 1,00,000 units + ₹ 12,500 × 4 years)	1,00,50,000
Administration costs (₹ 50,000 × 4 years)	2,00,000
Warranty expenses	
Replacement costs: {(1,00,000 units ÷ 25 units) × 5 parts × ₹ 10}	2,00,000
Visit costs: {(1,00,000 units ÷ 500 units) × 1 visit × ₹ 500}	1,00,000
Total Cost	2,40,75,000

Statement showing Kent's Life Time Profit

Particulars	₹ at the level of 80,000 units	₹ at the level of 1,00,000 units
Sales	(80,000 × 300) = 2,40,00,000	(1,00,000 × 255) = 2,55,00,000
Total cost	1,95,15,000	2,40,75,000
Profit	44,85,000	14,25,000

Observation: Reducing the price by 15% will decrease profit by ₹ 30,60,000/-. Therefore, SRM Ltd. should not cut the price.

Asset Life Cycle Costing

3.7

CIMA defines Life-Cycle Costing as ‘Maintenance of physical asset cost records over entire asset lives, so that decisions concerning the acquisition, use or disposal of assets can be made in a way that achieves the optimum asset usage at the lowest possible cost to the entity. The term may be applied to the profiling of cost over a product’s life, including the pre-production stage (terotechnology), and to both company and industry life cycles.

Life Cycle Cost (LCC) may, thus, be stated as “The total cost throughout the life of an asset including planning, design, acquisition and support costs and any other costs directly attributable to owning or using the asset”. Life Cycle Cost (LCC) of any item represents costs of its acquisition, operation, maintenance and disposal.

Life Cycle Cost Analysis is used to examine and assess the total cost of resource ownership and takes into account expenses related to buying, maintaining, operating and disposing of a project or an object. It is used especially to select the best project when there are multiple projects that satisfy the same performance requirements, but differ in terms of operating costs and initial costs which must be compared for selecting the method for maximization of net savings.

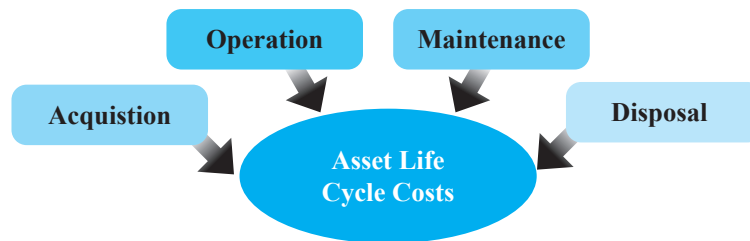


Figure 3.11 : Some of the Aspects of Asset Life Cycle Costs

The purpose of LCC analysis is the estimation of the overall cost of project options and then to select the designs which can ensure the facility to provide the overall lowest cost of ownership constant with the function and its quality. The analysis should be performed at an early stage so that there will be chances of refining the design to ensure the reduction in life cycle total cost. The most challenging assignment of this analysis or any economic evaluation technique is to ascertain the economic effects of alternate designs of a building system and quantify these effects in the monetary terms. The process involves assessing cost arising from the assets of the company over some time and evaluating alternatives which impact on the cost ownership.

Life Cycle cost analysis appropriately weighs the money spent today as compared to money spent in the future. The basic formula is:

$$\text{LCC} = C + \text{PV Recurring} - \text{PV Residual Value}$$

Where:

- ‘LCC’ is the life cycle cost
- ‘C’ is the 0-year acquisition cost

Strategic Cost Management

- 'PV' recurring is the present value of all recurring costs
- 'PV' residual value is the present value of residual-value at the end of the life of the asset.

Life Cycle Costs of an Asset includes:

- Acquisition
- Installation
- Operating
- Maintenance
- Financing (e.g., interest)
- Depreciation
- Disposal

Example of Life Cycle Cost of a printer

- **Purchase:** The price is ₹20,000.
- **Installation:** ₹500 for setting up and delivery purposes.
- **Operating:** ₹2,000 for ink cartridges and paper for it. Cost of electricity is expected at ₹300.
- **Maintenance:** Repairs will cost ₹500.
- **Financing:** Interest rate of 9% per annum.
- **Depreciation:** Value will be reduced by ₹2,000 each year.
- **Disposal:** Estimation of hiring a contractor to remove the printer is ₹ 150.

Even though the price of the printer is ₹20,000, the life cycle cost of the printer will end up costing the business much more.

Case Study: LC Margin for an Orange Plantation Project

The application of LCC can be universal across the multiple sectors of the economy. Here follows the summarised (basic) computations of LCC relating to an Orange Plantation Project. These computations have been carried out on the basis of inputs provided by a couple of farmers.

Annual Cash Outflow

The annual cash outflow budget for the said plantation would be as follows:

Annual cash outflow Budget of Orange Plantation Project				
Serial	Item	Year 1	Year 2 to Year 5	Year 6 to Year 18
		(₹)	(₹)	(₹)
A	Month wise Details			
1	April			
	Land Acquisition	40,00,000		

Annual cash outflow Budget of Orange Plantation Project				
Serial	Item	Year 1	Year 2 to Year 5	Year 6 to Year 18
		(₹)	(₹)	(₹)
	Levelling & Dressing	1,00,000		
	Fencing	96,000		
	Pits	10,000		
	Nutrients in Pit	50,000		
	Attached Labour	7,000	7,000	7,000
	Hired Labour			6,000
	Organic Manure @ 2 trolleys per acre			32,000
	Transport and Labour Charges			8,000
	Sub Total	42,63,000	7,000	53,000
2	May			
	Dug Well (10ft dia × 50ft deep)	2,45,000		
	Attached Labour	7,000	7,000	7,000
	Sub Total	2,52,000	7,000	7,000
3	June			
	Dug Well (10ft dia × 50ft deep)	1,05,000		
	Electric Connection	25,000		
	Motor (5HP)	30,000		
	Cables & Other Equipment	10,000		
	Piping	50,000		
	Drip System	2,40,000		
	Misc. Works	25,000		
	Electricity	4,000	4,000	4,000
	Attached Labour	7,000	7,000	7,000
	Interest on Working Capital			4,617
	Sub Total	4,96,000	11,000	15,617

Annual cash outflow Budget of Orange Plantation Project				
Serial	Item	Year 1	Year 2 to Year 5	Year 6 to Year 18
		(₹)	(₹)	(₹)
4	July			
	Plants (125 per acre × 8)	50,000		
	Attached Labour	7,000	7,000	7,000
	Hired Labour	4,000		
	Sub Total	61,000	7,000	7,000
5	August			
	Nutrients	14,000	14,000	10,700
	Misc. Works	7,500	7,500	
	Attached Labour	7,000	7,000	7,000
	Sub Total	28,500	28,500	17,700
6	September			
	Interculture & Weed Control	7,500	7,500	5,075
	Pesticides	7,500	7,500	10,500
	Plant Support Wood			10,000
	Electricity	4,000	4,000	4,000
	Attached Labour	7,000	7,000	7,000
	Hired Labour	5,000	5,000	9,000
	Interest on Working Capital			4,617
	Sub Total	31,000	31,000	50,192
7	October			
	Replacement Plants	10,000		
	Nutrients	14,000	14,000	
	Pesticides			10,500
	Misc. Works	7,500	7,500	

Annual cash outflow Budget of Orange Plantation Project				
Serial	Item	Year 1	Year 2 to Year 5	Year 6 to Year 18
		(₹)	(₹)	(₹)
	Attached Labour	7,000	7,000	7,000
	Hired Labour	3,000	3,000	
	Sub Total	41,500	31,500	17,500
8	November			
	Interculture & Weed Control	7,500	7,500	5,075
	Pesticides	7,500	7,500	
	Attached Labour	7,000	7,000	7,000
	Hired Labour	4,000	4,000	3,000
	Sub Total	26,000	26,000	15,075
9	December			
	Nutrients	12,000	12,000	
	Pesticides			9,000
	Misc. Works	3,750	3,750	
	Electricity	4,000	4,000	4,000
	Attached Labour	7,000	7,000	7,000
	Hired Labour	2,000	2,000	3,000
	Interest on Working Capital			4,617
	Sub Total	28,750	28,750	27,617
10	January			
	Misc. Works	3,750	3,750	
	Attached Labour	7,000	7,000	7,000
	Hired Labour	2,000	2,000	3,000
	Sub Total	12,750	12,750	10,000

Annual cash outflow Budget of Orange Plantation Project				
Serial	Item	Year 1	Year 2 to Year 5	Year 6 to Year 18
		(₹)	(₹)	(₹)
11	February			
	Misc. Works	3,750	3,750	
	Attached Labour	7,000	7,000	7,000
	Hired Labour	2,000	2,000	3,000
	Sub Total	12,750	12,750	10,000
12	March			
	Misc. Works	3,750	3,750	
	Electricity	4,000	4,000	4,000
	Attached Labour	7,000	7,000	7,000
	Hired Labour	2,000	2,000	3,000
	Interest on Working Capital			4,617
	Sub Total	16,750	16,750	18,617
B	Summary			
	April	42,63,000	7,000	53,000
	May	2,52,000	7,000	7,000
	June	4,96,000	11,000	15,617
	July	61,000	7,000	7,000
	August	28,500	28,500	17,700
	September	31,000	31,000	50,192
	October	41,500	31,500	17,500
	November	26,000	26,000	15,075
	December	28,750	28,750	27,617
	January	12,750	12,750	10,000
	February	12,750	12,750	10,000
	March	16,750	16,750	18,617
	Total	52,70,000	2,20,000	2,49,318

The total cash outflow during the first year would aggregate to ₹52.70 lakhs, consisting of ₹50.50 lakhs of initial investment and annual nurturing cost of ₹2.20 lakhs. The nurturing outflow would continue at the rate of ₹2.20 lakhs per year till the 5th year. The annual operating outflow would work out to ₹2.49 lakhs from the 6th year to the 18th year. Such of these annual cash budgets would go a long way in facilitating the farmers in planning, coordinating and controlling their cash outflows.

Life Cycle Margin

The computations relating to Life Cycle Margin of the above project are as follows:

LC Margin per Plant of Oranges		
A	Quantitative Data	
	Plantation Area (Acres)	8
	Number of Plants per Acre	125
	Number of Plants per 8 Acres (No. of Plants / Acre × Plantation Area)	1000
	Life (Years)	18
	Nurturing Period (Years)	5
	Cropping Period (Years) (Life – Nurturing Period)	13
	Life Cycle Yield per Plant (Kg)	940
	Selling Price (₹ Per Kg)	31
B	Investment (₹ Lakhs)	
1	Land	41.96
2	Water Distribution Systems	7.30
3	Plantation	1.24
4	Nurturing Cost for the first 5 years	11.00
5	Total	61.50
C	Means of Finance (₹ Lakhs)	
1	Own Funds	21.80
2	Subsidies	2.80
3	Loan Funds	36.90
4	Total	61.50
D	Life Time Plantation Cost	
1	Plantation Cost per Annum (₹)	
	i. Nutrients	50,700
	ii. Interculture & Weed Control	10,150
	iii. Pesticide Spray	30,000

	iv. Plant Support Wood	10,000
	v. Electricity	16,000
	vi. Labour	1,14,000
	vii. Interest on Working Capital	18,468
	viii. Total	2,49,318
2	Plantation Cost for 13 Years (₹ Lakhs)	32.41
E	Life Cycle Cost (₹ Lakhs)	
1	Investment	61.50
2	Interest on Term Loan	25.99
3	Plantation Cost from year 6 to year 18	32.41
4	Life Cycle Cost (1 + 2 + 3)	119.90
F	Life Cycle Margin per Plant (₹)	
1	Life Cycle Revenue per Plant (940 kg × ₹31)	29140
2	Life Cycle Cost per Plant (1,19,90,000 ÷ 1000)	11990
3	Life Cycle Margin per Plant (1-2)	17150
4	Average Margin per Plant per annum (3 ÷ 18)	953

As could be seen from the computations, a model farmer would be able to earn a Life Cycle Margin ₹17,150 per plant of oranges over a period of 18 years which works out to ₹953 per plant per year. Thus, the margin computes to ₹1,19,125 per acre (of 125 plants) per annum which is quite attractive and competitive apparently. A note of caution, however, is that the case study under reference is demonstrative in nature and does not consider time value of money.

It is also relevant to observe that there are no revenues during the first five years of the plantation which is the nurturing period. The revenue flow starts from the 6th year and continues upto the 18th. Thus, the adoption of the principles of Life Cycle Costing to any horticulture project would not only facilitate 'Overall Cost Analysis', but also would bring out an 'Holistic View'.

Illustration 50

A2Z plc. supports the concept of zero technology or life cycle costing for new investment decisions covering its engineering activities. The financial side of this philosophy is now well established, and its principles extended to all other areas of decision making. The company is to replace a number of its machines and the Production Manager is torn between the Exe Machine, a more expensive machine with a life of 12 years, and the Wye machine with an estimated life of 6 years. If the Wye machine is chosen it is likely that it would be replaced at the end of 6 years by another Wye machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below:

	Exe (₹)	Wye (₹)
Purchase Price	19,000	13,000

	Exe (₹)	Wye (₹)
Trade-in value/breakup/scrap	3,000	3,000
Annual repair costs	2,000	2,600
Overhaul costs	(at year 8) 4,000	(at year 4) 2,000

Estimated financing costs averaged over machine life 10% p.a - Exe; 10% p.a. – Wye.

You are required to: recommend with supporting figures, which machine to purchase, stating any assumptions made.

Solution:

Computation of present value of outflows and equivalent annual costs

	Working (₹)	Exe machine (₹)	Working (₹)	Wye machine (₹)
Initial cost		19,000.00		13,000.00
Less: Present Value of Scrap at the end of the life	(3000×0.319)	957.00	(3000×0.564)	1,692.00
Net Cost		18,043.00		11,308.00
Add: Present value of total annual repair costs	(2000×6.812)	13,624.00	(2600×4.354)	11,320.00
Add: Overhaul costs	(4000×0.466)	1,864.00	(2000×0.683)	1,366.00
P.V. of Total Cost		33,531.00		23,994.00
Capital recovery factor	$(1 \div 6.812)$	0.1468	$(1 \div 4.354)$	0.2297
Equivalent annual cost		4,922.35		5,511.42

Recommendation: As the equivalent annual cost is less for Exe machine, it is better to purchase the same.

Working Note

- Present Value Factors @ 10%:** Year4 =0.683; Year6 =0.564; Year8=0.466; Year12=0.319
- Compounded Present Value (PVAF) @ 10%:** 8 years = 4.354; 12 years = 6.812

Illustration 51

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10%.

Which machine Company X should buy?

Solution:

Compounded present value of 3 years @ 10%		2.486
-------------------------------------------	--	-------

P.V. of Annual running cost of Machine A for 3 years	₹ 40,000 × 2.486	₹ 99,440
Compounded present value of 2 years @ 10%		1.735
P.V. of Annual running cost of Machine B for 2 years	₹ 60,000 × 1.735	₹ 1,04,100

Statement Showing Evaluation of Machine A and B

(₹)

Particulars	Machine A	Machine B
Cost of purchase	1,50,000	1,00,000
Add: P.V. of running cost	99,440	1,04,100
P.V. of Cash outflow	2,49,440	2,04,100
Equivalent present value of annual cash outflow / EAC	2,49,440 ÷ 2.486 = 1,00,338	2,04,100 ÷ 1.735 = 1,17,637

Suggestion: Since the annual cash outflow of Machine B is higher, purchase of Machine A is recommended.

Illustration 52

(Computation of Equivalent Annual Cost and Identification of Year to Replace the Machine)

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of eight years, it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Amount (₹)

Year	Maintenance	Salvage
Present %	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%.

When should the company replace the machine?

(Notes: Present value of an annuity of ₹1 per period for 8 years at interest rate of 15%: 4.4873; present value of ₹ 1 to be received after 8 years at interest rate of 15%: 0.3269)

Solution:

Step1: Calculation of Equivalent Annual Cost of New Machine

Particulars	Working	Amount (₹)
Cost of New Machine		90,000

Particulars	Working	Amount (₹)
Add: Present value of annual maintenance cost for 8 years	(₹ 10,000 × 4.4873)	44,873
		1,34,873
Deduct: Present value of salvage value at the end of 8 th year	(₹ 20,000 × 0.3269)	6,538
Total present value of life cycle cost of new machine		1,28,335

Equivalent annual cost of New Machine = ₹ 1,28,335 ÷ 4.4873 = ₹ 28,600

Step2: Calculation of Present Value of Maintenance & Salvage of Existing Machine

Year	PVF @ 15%	Maintenance (₹)		Salvage Value (₹)	
		Annual Value	Present Value	Annual Value	Present Value
0	0	0		40,000	40,000
1	0.870	10,000	8,700	25,000	21,750
2	0.756	20,000	15,120	15,000	11,340
3	0.658	30,000	19,740	10,000	6,580
4	0.572	40,000	22,880	0	0

Step 3: Calculation of Equivalent Annual Cost of Existing Machine

Year	PV of Opening Salvage Value	Add: PV of Maintenance Cost	Deduct: PV of Closing Salvage Value	Equivalent Annual Cost
1	40,000	8,700	21,750	26,950
2	21,750	15,120	11,340	25,530
3	11,340	19,740	6,580	24,500
4	6,580	22,880	0	29,460

Step 4: Comparison of Equivalent Annual Cost

Year	New Machine (₹)	Existing Machine (₹)	(New – Existing)
1	28,600	26,950	1,650
2	28,600	25,530	3,070
3	28,600	24,500	4,100
4	28,600	29,460	(860)

Suggestion: Equivalent Annual Cost of New Machine is higher for the first 3 years and is lower by ₹860/- in the 4th year. Therefore, it is desirable to replace the existing machine after the third year.

Illustration 53 (Expected NPV)

A company is considering the purchase of a machine for ₹ 3,50,000. It feels quite confident that it can sell the goods produced by the machine as to yield an annual cash surplus of ₹ 1,00,000. There is however uncertainty as to the machine working life. A recently published Trade Association Survey shows that members of the Association have between them owned 250 of these machines and have found the lives of the machines vary as under:

No. of year of Machine life	3	4	5	6	7	Total
No. of machines having given life	20	50	100	70	10	250

Assuming discount rate of 10% the net present value for each different machine life is follows:

Machine life	3	4	5	6	7
NPV (₹)	(1,01,000)	(33,000)	29,000	86,000	1,37,000

You required to advice whether the company should purchase a machine or not.

Solution:

Computation of Expected NPV of an asset considering the probability of life of machine.

Year	Probability (a) (₹)	NPV (b) (₹)	Expected Value (a × b)
3	20/250 = 0.08	(1,01,000)	(8,080)
4	50/250 = 0.2	(33,000)	(6,600)
5	100/250 = 0.4	29,000	11,600
6	70/250 = 0.28	86,000	24,080
7	10/250 = 0.04	1,37,000	5,480
	Total = 1		26,480

Since, the Expected NPV is Positive.

Therefore, the advice, therefore, is for purchasing the machine.

Decision Making Using Probability

3.8

Strategic Cost Management Techniques both use and depend on the information probability distributions provide. A probability distribution establishes a statistical relationship between two or more variables and the chances of each occurring. For business enterprises, which often experience volatility, probability distributions are useful decision-making tools for both maximizing profits and controlling associated costs. Using probability distribution, instead of making an informed best guess, is a way to reduce some of the uncertainties inherent in a subjective planning or cost management decision.

Probability Distribution

A probability distribution is a statistical function that describes all the possible values and likelihoods that a random variable can take within a given range. This range will be bounded between the minimum and maximum possible values, but precisely where the possible value is likely to be plotted on the probability distribution depends on a number of factors. These factors include the distribution's mean (average), standard deviation, skewness, and kurtosis. Perhaps, the most common probability distribution is the normal distribution, or 'bell curve', although several distributions exist that are commonly used. The term 'bell curve' originates from the fact that the graph used to depict a normal distribution consists of a symmetrical bell-shaped curve. A probability distribution, thus, is a statistical tool that shows the possible outcomes of a particular event or course of action as well as the statistical likelihood of each event. For example, a company might have a probability distribution for the change in sales given a particular marketing campaign. The values on the "tails" or the left and right end of the distribution are much less likely to occur than those in the middle of the curve.

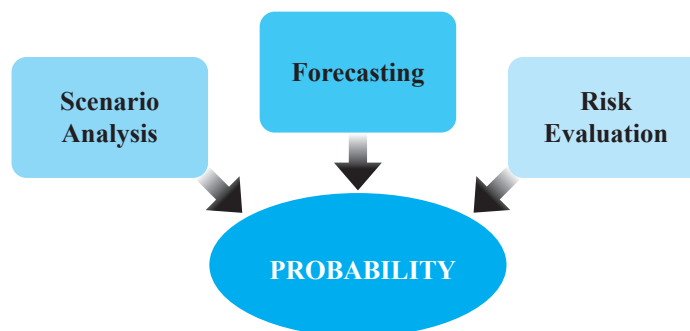


Figure 3.12 : Applications of Probability

Applications

Scenario Analysis: Probability distributions can be used to create scenario analysis. A scenario analysis uses probability distributions to create several, theoretically distinct possibilities for the outcome of a particular course of action or future event. For example, a business might create three scenarios: 'worst-case', 'likely' and 'best-case'. The worst-case scenario would contain some value from the lower end of the probability distribution; the likely scenario would contain a value towards the middle of the distribution; and the best-case scenario would contain a value in the upper end of the scenario

Forecasting: One practical use for probability distributions and scenario analysis in business is to predict future levels of sales and costs. It is essentially impossible to predict the precise value of a future sales level or cost movements; however, businesses still need to be able to plan for future events. Using a scenario analysis based on a probability distribution can help a company frame its possible future values in terms of a likely sales level, cost estimations and a worst-case and best-case scenario. By doing so, the company can base its business plans on the likely scenario but still be aware of the alternative possibilities.

Risk Evaluation: In addition to predicting future sales levels, probability distribution can be a useful tool for evaluating risk. Consider, for example, a company considering entering a new business line. If the company needs to generate ₹5.00 crore in revenue in order to break even and their probability distribution tells them that there is a 10 percent chance that revenues will be less than ₹5.00 crore, the company knows roughly what level of risk it is facing if it decides to pursue that new business line.

Case Study: SCM can boost up the Benefits from IQF

Introduction

SA Limited is a moderate MSME located in rural Maharashtra. It is engaged in the business of processing of raw vegetables through the technique of Individual Quick Freezing (IQF). IQF enhances the shelf-life of vegetables to about 18 to 24 months from the date of the packing. The frozen vegetables are to be stored below minus twenty degrees centigrade. Fresh vegetables of various kinds are the raw material. The capacity of the unit is 600 MT of vegetables per month.

IQF process is continuous and, broadly, consists of:

- i. Raw Material Preparation
- ii. Blanching
- iii. Freezing
- iv. Primary Packing
- v. Cold Storage
- vi. Secondary Packing

Raw Material Preparation involves cleaning, washing, peeling, cutting, slicing, etc. of the fresh vegetables; which are then taken up for blanching wherever necessary; and processed through the freezing machinery. Primary packing consists of bulk packing for cold storage and secondary packing consists of custom packing made to orders. The frozen vegetables can be sold in domestic market and exported to various developed countries all over the world. Refrigerated containers are used for the carriage of finished goods.

Lucrative aspects of the business include:

- 1. Increasing Demand:** Vegetables are essential commodities. Demand is ever increasing with the increase in population and change in consumption pattern i.e., more inclination towards the vegetarian food. As a consequence, the demand and supply gap has also been increasing.
- 2. Cheap Labour:** The unit is located in a rural area. Cheap and trained labour is available locally.
- 3. Export Potential:** Export market exists to absorb the 100% production capacity of the plant.
- 4. Strong Bottom Line:** The industry is quite profitable and the bottom line is very strong.

The company posted the following financial results for the year 2020-21:

SA Limited: Financial Results for 2020-21

Serial	Item	₹ Lakhs
A	Revenue	
	1. Sales (5400 MT at an average price of ₹ 45,000 per MT)	2430.00
	2. Increase in Stocks (600 MT @ ₹ 40,000 per MT)	240.00
	3. Total	2670.00
B	Variable Costs	
	1. Raw Material	1075.00
	2. Variable Conversion Expenses	400.00
	3. Other Variable Expenses	275.00
	4. Total	1750.00
C	Contribution	920.00
D	Fixed Expenses	
	1. Fixed Conversion Expenses	250.00
	2. Other Fixed Expenses	200.00
	3. Total	450.00
E	EBITA	470.00
F	Interest	160.00
G	Depreciation	60.00
H	Profit Before Tax	250.00
I	Tax	75.00
J	Profit After Tax	175.00

Key Features

Seasonal Raw material: Vegetables are agri season specific. Sowing schedule and harvesting calendar differs from vegetable to vegetable. For example, bitter gourd is sown in April–May and comes up for harvesting in August–September; Beans are sown in October–November and are harvested in January–February; and so on. Fresh vegetables are, therefore, to be processed in the season in which they are available. Carrying out the production

as per the season of the raw material is the first key feature of the industry. Off-season procurement of any fresh vegetable is very costly and unviable. The previous experience is that the company has to resort to off season buying to the extent of 25% of its procurements.

Yearlong Assorted Demand: The demand, local as also the export, is for that of assorted mix of the vegetables yearlong. For example, a health-conscious consumer would like to have beans in the morning and bitter gourd in the evening once a week yearlong. Further, as tastes and habits differ from region to region and country to country, different categories of customers keep demanding different compositions of order mix. Impliedly sale-mix varies from customer to customer and from order to order.

Considering the facts of seasonal raw materials and assorted yearlong demand, it turns out that only 35% of the vegetables can be supplied from the current production whereas substantial quantities are to be supplied from the stored-stocks. The resultant impact is that product-stock is build up on the basis of availability of raw material and product-disposal takes place on the basis of yearlong demand.

Maintaining adequate stock of finished goods in anticipation of the yearlong assorted requirements of the customers warrants building up sufficient stock of every item of frozen vegetable round the year. The financial implications are:

- a. Huge investments in working capital which works out to six months holding of finished products; and
- b. High carrying costs on account of cold storage.

Strategic Plan

Cost Managers of SA Ltd analysed the situation and observed that seasonal availability of raw materials is the primary bottleneck. Yearlong demand, no doubt, is a strong point; but assorted sales mix is the weak connection. The strategy should address the issue of continuous and assured supply of raw materials at viable prices throughout the year. The company has, therefore, designed a backward integration methodology by means of a tie-up with a local Farmer Producer Organisation (FPO). To start with, vegetable wise annual demand and the farm land needed for the exclusive cultivation of these vegetables have been computed as detailed in table 1.

Table 1: Annual Demand

Serial	Vegetable	Fresh Vegetables (MT)	Yield per Acre (MT)	Farm Land (Acres)
1	Beans	1000	8	125
2	Bitter Gourd	480	15	32
3	Bottle Gourd	330	15	22
4	Cauliflower	1080	20	54
5	Carrot	324	18	18
6	Chillies	260	20	13
7	Ivy Gourd	378	18	21
8	Onion Red	828	18	46
9	Onion white	900	18	50
10	Okra	820	10	82

Serial	Vegetable	Fresh Vegetables (MT)	Yield per Acre (MT)	Farm Land (Acres)
11	Pumpkin	400	20	20
12	Yam	216	18	12
13	Total	7016		495

As may be observed from table 1, it is estimated that sowing in 495 acres of dedicated land can fulfill the demand of 7016 MT for fresh vegetables and help optimum utilisation of production facilities by the company. After taking into account the local agricultural practices and the productivity factors; the Company and the FPO, together, compiled the feasible sowing season time table and the harvesting season calendar for the vegetables as detailed in table 2.

Table 2: Sowing Season Time Table and Harvesting Season Calendar

Serial	Vegetable	Sowing Season Time Table	Harvesting Season Calendar
1	Beans	Oct – Nov	Nov-Feb
2	Bitter Gourd	April – May	July - Oct
3	Bottle Gourd	Jul – Sep	Sep - Nov
4	Cauliflower	Oct - Nov	Dec - Mar
5	Carrot	Jan – Feb	Apr - May
6	Chillies	Jul – Aug	Oct - Nov
7	Ivy Gourd	Jun – Jul	Sep – Nov
8	Onion Red	Nov – Dec	Apr - July
9	Onion white	Nov – Dec	Mar - Aug
10	Okra	Feb – Mar	Mar - July
11	Pumpkin	Jan – Feb	Sep - Nov
12	Yam	May – Jun	Aug – Sep

The sowing and harvesting schedules were then synchronized and a sowing plan as in table 3 and a harvesting plan as in table 4 were prepared. The target was the marginal and small farmers located within a radius of 30km from the plant.

Table 3: Sowing Plan

(Figures in Acres)

Sl.	Vegetable	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	Beans							65	60					125
2	Bitter Gourd	16	16											32

Sl.	Vegetable	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
3	Bottle Gourd				6	8	8							22
4	Cauliflower							27	27					54
5	Carrot										9	9		18
6	Chillies				6	7								13
7	Ivy Gourd			10	11									21
8	Onion Red								23	23				46
9	Onion white								25	25				50
10	Okra											40	42	82
11	Pumpkin										10	10		20
12	Yam		6	6										12
13	Total	16	22	16	23	15	8	92	135	48	19	59	42	495

Table 4: Harvesting and Procurement Plan

(Figures in MT)

Sl.	Vegetable	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
1	Beans								100	350	350	200		1000
2	Bitter Gourd				120	120	120	120						480
3	Bottle Gourd						120	30	180					330
4	Cauliflower									235	245	380	220	1080
5	Carrot	162	162											324
6	Chillies							160	100					260
7	Ivy Gourd						130	135	113					378
8	Onion Red	207	207	187	227									828
9	Onion white	100	125	225	40	285							125	900
10	Okra	125	100	175	170								250	820
11	Pumpkin						160	150	90					400
12	Yam					150	66							216
13	Total	594	594	587	557	555	596	595	583	585	595	580	595	7016

In view of the tie up with the FPO, the harvesting plan of the farmers becomes the procurement plan for the company. Proforma Cultivation Cost Sheets were developed for each of the vegetables on the basis of a model

plot. Considering the insights provided by these cost sheets as the base, farmers were offered predetermined prices formulated at cost plus 100% model.

Farmers were also encouraged to undertake collective buying of the inputs through the FPO. The executives of the FPO, in coordination with the cost controllers of the company, kept on guiding the farmers in adhering to the pre-framed time schedules and agri cost controls on a concurrent and continuous basis.

Expected Advantages

The implementation of the afore stated strategy is expected to bring forth the following advantages over the ensuing couple of years.

A. Benefits exclusive to the Farmers

Farming income for the locals is visualised to increase at least by 50% because of the following factors:

- (i) The productivity of the cultivation is expected to go up by 20%.
- (ii) The cost of cultivation is expected to come down by 15%.
- (iii) Farmers are expected to receive 20% higher prices than the market.
- (iv) Sales being assured, farmers are totally protected from the risk of distress selling.

B. Benefits exclusive to the Company

The bottom line (profit) of the company is assumed to prop up by thirty percent on account of the following advantages:

- (i) The company is assured of smooth supply of raw materials at predetermined prices leading to smoothened production schedule throughout the year.
- (ii) Off-season buying having been prevented; the buying costs can be reduced by five to ten percent.
- (iii) Despatches from current stock can be increased to beyond 50% in place of the existing quantum of 35%. Consequently, the stock holding can be reduced by 600 MT and carrying costs can be reduced by 15%.
- (iv) Reduction in stocks is expected to bring down the working capital needs by ₹ 200 lakhs with a resultant interest saving of ₹ 24 lakhs per annum.
- (v) Increased quantum of despatches from current stocks would minimise the bulk packing with a consequential reduction in bulk packing cost to the extent of at least 20%.
- (vi) Procurements having been synchronized with vegetable seasons; process wastages of raw materials can be brought down by 20%.
- (vii) Quality measures of the product can be initiated at the farming level itself with specific focus on customers' tastes and preferences.

C. Integration of Value Chain

Data Modeling and Budgetary controls can be introduced and applied throughout the integrated value chain comprising agri activities and processing activities. Eventually, farming community can be taught to implement the techniques of marginal costing and target costing for achieving higher crop productivity.

Learning Pack

The following ground realities are worth learning from the strategic exercise of SA Limited.

- Identification of the bottleneck is the first step for any strategic maneuver.
- Designing a sustainable backward integration can provide a winning edge to an agro based industry.
- Evolving feasible sowing and harvesting plans are the key success decisions that have mutually benefited the farmers and the company.
- Execution of the plans with care and caution is vital for the ultimate competitive advantage.
- Steering towards the targeted margin generation is the SCM (Strategic Cost Management) forte.

Everything said, IQF is an agro based industry that can be instrumental in augmenting farmers' income, enhancing the industrial productivity and strengthening the export potential of the country. The benefits drawn from such an industry can be bolstered by means of Strategic Cost Management Systems and Techniques.

Case Study: Cost Optimisation of Indian Sugar Sector

1. Indian Sugar Industry

With an annual production capacity of over 350 lakh metric tonnes, the Indian Sugar Industry is the second largest producer of sugar in the world. Sugar can be produced from sugarcane, sugar-beet or any other crop having sugar content. But in India, sugarcane is the main source of sugar. At present, this is the second largest agro-based industry of India after cotton textiles.

Indian Sugar industry contributes significantly to socio-economic development of the rural population as well. It is a source of livelihood for about 6 crores of farmers and their families; and provides direct employment to over 5 lakh skilled and semi-skilled human resources in sugar mills and allied industries across the country.

As of date, Indian sugar industry's annual output approximates to 85,000 crores of rupees with about 530 sugar factories in operation (installed mills being 735). The industry contributes about ₹ 4,000 crores to the central exchequer, apart from giving about ₹ 1,500 crores to the State Governments. The annual consumption of sugar in India has been in the range of 250 lakh tones.

2. Sugarcane Prices

The prices of sugarcane in India are government driven through the mechanism of 'Fair and Remunerative Price' (FRP).

The FRP announced by the Central Government, every year, is decided on the basis of the recommendations of the Commission for Agricultural Costs and Prices (CACP) and in consultation with the State Governments. CACP takes into account the following factors while fixing the FRP:

- i. Cost of production of sugarcane;
- ii. Return to the growers from alternative crops and the general trend of prices of agricultural commodities;
- iii. Availability of sugar to consumers at a fair price;
- iv. Selling Price of sugar;
- v. Recovery rate of sugar from sugarcane;
- vi. Revenue from sale of by-products viz. molasses, bagasse and press mud or their imputed value; and
- vii. Reasonable margins, reportedly 50%, for the growers of sugarcane on account of risk and profits.

The specific stipulation is that FRP is the minimum price that shall be paid to the cane growers. In order to ensure that higher sugar recoveries are adequately rewarded, the FRP is linked to a basic recovery rate of sugar, with a premium payable to farmers for higher recoveries of sugar from sugarcane. Some of the state governments go a step further and tend to implement a State Advised Price (SAP) by fixing cane price over and above the FRP. The system is, obviously, designed to assure adequate and attractive margins to farmers.

3. Sugar Pricing Policy

Sugar prices are market determined. However, the concept of Minimum Selling Price (MSP) of sugar has been introduced with effect from 07.06.2018 so that the industry may get at least the minimum cost of production of sugar, and also to enable them to make time bound cane payments to the farmers. It has been stated by the policy formulators that MSP takes into account the components of Fair & Remunerative Price (FRP) of sugarcane and minimum conversion cost of the most efficient sugar mills.

4. Cane Margin

Cane Margin reflects the excess of 'Operating Revenue' (i.e., the revenue arising from the sale of sugar and its by-products) over the 'Landed Cost' of sugar cane. In other words, Cane Margin is the throughput margin available to the sugar manufacturer to defray the conversion expenses and also, thereafter, to generate due profits for the risk-bearing shareholders.

As such, 'Throughput (Cane) Margin' is of utmost importance from the perspective of viable sugar manufacturing and more so in the context of regulated pricing environment prevailing in India

The applicable FRP mechanism for sugar season 2021-22 in relation to cane is ₹ 290/- per quintal linked to a basic sugar recovery of 10% subject to a premium of ₹ 2.90 per quintal for each 0.1% increase of recovery over and above 10% and reduction in FRP at the same rate for each 0.1% decrease in the recovery rate till 9.5%. There shall not be any further deduction in case where recovery is below 9.5%. The MSP for sugar has been fixed at ₹ 31/- per kg with effect from 14.02.2019.

In accordance with the said mechanism of cane pricing and sugar pricing, sensitivity of throughput margin per MT of cane at 9.50%, 10.00%, 10.50%, and 11.00% levels of recovery rates of sugar are computed and furnished in a tabular form.

The computations consider recovery of by-products of molasses @ 4%, bagasse @ 30% and press mud @ 4% of the cane crushed. By-product pricing is done at ₹ 6,000/- per MT of molasses, ₹ 2,000/- per MT of bagasse and ₹ 100/- per MT of press mud.

Sensitivity of Throughput Margin per MT of Cane

Sl	Particulars	Workings			
1	Sugar Recovery %	9.50	10.00	10.50	11.00
2					
	a. Sugar	95	100	105	110
	b. Molasses @ 4%	40	40	40	40
	c. Bagasse @30%	300	300	300	300
	d. Press Mud @4%	40	40	40	40

Sl	Particulars	Workings			
3	Operating Revenue (₹)				
	a. Sugar @ ₹ 31/- per Kg	2945	3100	3255	3410
	b. Molasses @ ₹ 6/- per Kg	240	240	240	240
	c. Bagasse @ ₹ 2/- per Kg	600	600	600	600
	d. Press Mud @ ₹ 0.10- per Kg	4	4	4	4
	e. Sub Total	3789	3944	4099	4254
4	Landed Cost of Cane (₹)				
	a. Basic Price @ ₹ 2900/- per MT	2900	2900	2900	2900
	b. Premium @ ₹ 29/- per 0.1% of Recovery	-145	0	145	290
	c. Sub Total	2755	2900	3045	3190
5	Throughput Margin (₹)	1034	1044	1054	1064
6	Percentage to Operating Revenue				
	a. Landed Cost of Cane	72.71	73.53	74.29	74.99
	b. Throughput Margin	27.29	26.47	25.71	25.01

The following are the facts that may be evidenced from the table:

- Sugar revenue increases in direct proportion to the sugar recovery percentage; i.e., higher the sugar recovery %, higher the sugar revenue and vice versa.
- By-product revenue remains constant in absolute figures irrespective of changes in sugar recovery percentage.
- Landed cost of sugar cane increases in more than direct proportion to the sugar recovery percentage; i.e., higher the sugar recovery %, still higher the landed cost of sugar cane and vice versa. At the point where the sugar recovery rate is 9.50%, landed cost of sugar cane works out to ₹ 2755/- and computes to 72.71% of operating revenue. When the sugar recovery rate climbs up to 11.00%, i.e., by two percentage points, the landed cost also goes up-to ₹ 3190/- in absolute terms, but increases to 74.99%, i.e., by 2.28 points when expressed as percentage to operating revenue.
- Throughput Margin increases in less than direct proportion to the sugar recovery percentage; i.e., higher the sugar recovery %, partly higher the throughput margin and vice versa. At the point where the sugar recovery rate is 9.50%, throughput margin works out to ₹ 1034/- and computes to 27.29% of operating revenue. When the sugar recovery rate climbs up to 11.00%, i.e., by two percentage points, the throughput margin goes up-to ₹ 1064/- in absolute terms, but falls down to 25.01%, i.e., by 2.28 points when expressed as percentage to operating revenue.

The striking realisation is that the percentage of throughput margin with reference to the operating revenue keeps on coming down with the progressive increases in the sugar recovery rate.

It may be reiterated that Operating Revenue is the aggregate of the realizations from the sale of sugar which ranges between 77.72% and 80.16% and the balance being by-product revenue. Sugar realizations do

increase or decrease in direct proportion to the recovery rate; but the by-product realizations either remain constant or more practically may fall down marginally at higher recovery rates of sugar. The premium formulation of '₹2.90 per quintal for each 0.1% increase of recovery over and above 10%' does not consider the behaviour of by-product inflows; and assumes proportionate increase in the entire operating revenue; and hence anomalous behaviour.

5. Target Conversion Cost

As has been highlighted earlier, Indian Sugar Industry is characteristic to the specific feature of predetermined sugar as also cane prices. Hence, it is only conversion cost that is amenable to control by the sugar producer. The cost boundaries for the industry are, thus, set by the Throughput Margin wherein:

$$\text{Throughput Margin} = (\text{Operating Revenue}) - (\text{Landed Cost of Cane})$$

Moving further, as is the case with every enterprise, Profit After Tax (the bottom-line of performance) is preset by the opportunity cost of equity, i.e., the expected Return on Investments in relation to the capital expenditure incurred towards acquiring fixed and other manufacturing assets by the equity shareholders. Conversion cost of sugar shall, therefore, be limited to the excess of throughput margin over the preset profit after tax or in other words opportunity cost of equity. The relevant iteration may, thus, be formulated as:

$$\text{Conversion Cost} \leq (\text{Throughput Margin}) - (\text{Opportunity Cost of Equity})$$

It means that, it is just the conversion cost that any sugar manufacturer can play with and control. For instance, at a sugar recovery rate of 10.50%, the throughput margin of 25.71% as reduced by the preset opportunity cost of equity determines the maximum ceiling for the conversion cost. All the rest, both revenues as also the costs, are beyond the controlling periphery of the manufacturer. The cost management formula for Indian Sugar Industry is, thus, to be scripted as:

$$\text{Target Conversion Cost} \leq (\text{Operating Revenue}) - (\text{Landed Cost of Cane} + \text{Opportunity Cost of Equity})$$

Going back to our example, and assuming an Opportunity Cost of Equity of ₹ 60/- per MT of Cane, the target conversion cost may be worked out as:

$$\text{Target Conversion Cost} \leq \{(4059) - (3045 + 60)\} = 4059 - 3105 = ₹ 954/-$$

The mill should, therefore, limit its conversion cost to the affordable level of ₹ 954/-. And, this is where the adoption of time tested systems of Target Cost Management comes handy and relevant in relation to the cost optimisation efforts of Indian Sugar Industry.

Further, it is relevant to note that elements of conversion cost, in this context, include: power, steam, chemicals, plant operation expenses, other manufacturing expenses, wages, salaries, administrative expenses, interest and depreciation. Point to remember is that some of these elements are variable, some are semi-variable and the remaining are fixed. Therefore, the methods and techniques of control need to be a mix of multifold applications, i.e., by means of pre-determined standards, concurrent variance analysis, incessant target monitoring and so on. For example, consumption of power and steam can be optimized through continuous production; chemicals consumption can be minimized by monitoring the dosages; other plant operation expenses can be minimized through physical supervision; all the fixed expenses can be controlled by means of administered budgets and optimum utilization of the production facilities and so on.

6. Cost Optimisation

Indian sugar industry is known to have adopted well entrenched cost management systems relevant for the

industry such as process costing, marginal costing, budgetary control and so on. Further, several sugar mills are covered by statutory cost audit. The strength lies in visualizing the significance of the audit data and using it for routine cost management to tune up the existing systems and contain the costs with a synergic impact. It could be the daily manufacturing production report, weekly key performance indicators, monthly cost evaluations or season-end performance report – everything can be synchronized with cost audit data whereby the existing resources can be deployed and utilised in a better manner, thus, facilitating cost optimisation.

The illustrative examples that follow demonstrate the utility of probability in relation to decision making.

Illustration 54

A company has a choice among three products A, B and C for which the following estimates are available:

Estimated profits based on demand forecast (₹ '000)

	Market X	Market Y	Market Z
Product A	380	100	30
Product B	300	280	220
Product C	220	400	320

Probabilities are: X = 0.60, Y = 0.20, Z = 0.20

Which project should be undertaken by the company?

Solution:

In order to answer the question, it is desirable to take the help of a pay-off matrix which in turn demands the identification of the elements. e.g.; profits, events (demand), probabilities, actions (products A, B or C), outcomes represented by Expected Values (EVs). (Profit × Probability)

		Profit (₹ '000)	Probability	Expected Value (₹ '000)
Product A	X	380	0.6	228
	Y	100	0.2	20
	Z	30	0.2	6
	Total			254
Product B	X	300	0.6	180
	Y	280	0.2	56
	Z	220	0.2	44
	Total			280
Product C	X	220	0.6	132
	Y	400	0.2	80
	Z	320	0.2	64
	Total			276

From the above matrix it is evident that Product B having the maximum EV of ₹ 2,80,000 should be selected.

Illustration 55

You are given the following estimates for next year's budgeted sales and costs of a single product produced by Bee Ltd.:

Selling Price	₹ 12 per unit	
Sales Demand:	Units	Probability
	3200	0.50
	4000	0.30
	5000	0.20
Variable Cost per unit	(₹)	Probability
	5.00	0.30
	6.00	0.50
	7.00	0.20
Fixed Cost for the period	₹ 20,000	

Required:

- Expected value of sales for the period.
- Expected variable cost and contribution for the period.
- Expected profit or loss for the budgeted period.

Solution:

(1)	Expected Value of Sales:		(₹)
	Expected Sales × Profitability		
	$3,200 \times 0.5 = 1,600$		
	$4,000 \times 0.3 = 1,200$		
	$5,000 \times 0.2 = 1,000$	3,800 @ ₹12	45,600
(2)	Expected Variable Cost:		
	Unit Variable Costs × Probability		
	$₹ 5 \times 0.3 = 1.5$		
	$₹ 6 \times 0.5 = 3.0$		
	$₹ 7 \times 0.2 = 1.4$	$5.9 \times 3,800$	22,420
(3)	Expected Contribution		23,180

(4)	Expected Profit:		
	Expected Contribution		23,180
	(-) Fixed Cost		20,000
	Expected Profit		₹ 3,180

Illustration 56

A company has estimated the following demand level of its product:

Sales Volume (units)	10000	12000	14000	16000	18000
Probability	0.10	0.15	0.25	0.30	0.20

It has assumed that the sales price of ₹ 6 per unit, marginal cost of ₹ 3.50 per unit, and fixed costs of ₹ 34,000.

What is the probability that:

- The company will break-even in the period?
- The company will make a profit of at least ₹ 10,000?

Solution:**(a) Probability of Break-even for the period**

In order to break-even, the company must earn enough total contribution to cover its fixed costs. The contribution is ₹ 2.50 per unit (i.e.. 6 - 3.5).

$$\begin{aligned} \text{Break-even Sales} &= (\text{Fixed Cost} \div \text{Contribution per Unit}) \\ &= (34,000 \div 2.50) = 13,600 \text{ units} \end{aligned}$$

$$\text{Contribution required/ Contribution per unit} = ₹ 34,000/₹2.50 = 13600 \text{ units}$$

The probability that sales will equal or exceed 13,600 units is the probability that sales will be 14,000, 16,000 or 18,000 units which is $(0.25 + 0.30 + 0.20) = 0.75$ or 75%.

(b) Probability of earning Profit of ₹10,000

$$\begin{aligned} \text{Contribution Needed} &= (\text{Profit Needed} + \text{Fixed Cost}) \\ &= (10,000 + 34,000) = ₹44,000 \end{aligned}$$

$$\begin{aligned} \text{Desired Sales} &= (\text{Contribution Needed} \div \text{Contribution per Unit}) \\ &= (44,000 \div 2.50) = 17,600 \text{ units} \end{aligned}$$

The probability that sales will equal or exceed 17,600 units is the probability that sales will be 18,000 units which is 0.20 or 20%

Illustration 57

A company has estimated the unit variable cost of a Product to be ₹ 10, and the selling price is ₹ 15 per unit. Budgeted sales for the year are 20,000 units. Estimated fixed costs are as follows:

Fixed Cost p.a. (₹)	50,000	60,000	70,000	80,000	90,000
Probability	0.1	0.3	0.3	0.2	0.1

What is the probability that the company will equal or exceed its target profit of ₹ 25,000 for the year?

Solution:

The different outcomes for fixed cost are mutually exclusive events. If fixed costs are ₹ 50,000 for example, they can't be anything else as well.

Budgeted sales = 20,000 units

Budgeted Contribution per Unit = 15 - 10 = ₹ 5

Budgeted total contribution (20,000 × ₹5)	1,00,000
Target profit	25,000
Maximum fixed costs if target is to be achieved	75,000

Higher Profit would mean lower FC, other things remaining constant.

So, Pb that Co. will equal or Exceed its target profit of ₹ 25,000 = Pb that FC will be ₹ 75,000 or less.

The probability that fixed costs will be ₹ 75,000 or less is:

$$\begin{aligned}
 &= P(50,000 \text{ or } 60,000 \text{ or } 70,000) \\
 &= P(50,000) + P(60,000) + P(70,000) \\
 &= 0.1 + 0.3 + 0.3 \\
 &= 0.7 \text{ or } 70\%
 \end{aligned}$$

Illustration 58

The Managing Director of Y Ltd. has evolved some decision making to the operating division of the firm. He is anxious to extend this process but first wishes to be assured that decisions are being taken properly in accordance with group policy. As a check on existing practice, he has asked for an investigation to be made into a recent decision to increase the price of the sole product of Z division to ₹ 14.50 per unit but to rising costs. The following information and estimates were available for the management of Z division:

Last year 75,000 units were sold at ₹ 12 each with total units cost of ₹ 9 of which ₹ 6 were variable costs. For the year ahead the following cost and demand estimates have been made:

Variable costs:

Pessimistic	Probability 0.15	₹ 7.00 per unit
Most likely	Probability 0.65	₹ 6.50 per unit
Optimistic	Probability 0.20	₹ 6.20 per unit

Total fixed costs:

Pessimistic	Probability 0.3	Increase by 50%
-------------	-----------------	-----------------

Most likely	Probability 0.5	Increase by 25%
Optimistic	Probability 0.2	Increase by 10%

Demand estimates at various prices

Particulars	Probability	₹ 13.50 per unit	₹ 14.50 unit
Pessimistic	0.30	45,000	35,000
Most likely	0.50	60,000	55,000
Optimistic	0.20	70,000	68,000

(Unit variable costs, fixed costs and demand estimates are statistically independent)

For this type of decision the group has decided that the option should be chosen which has the highest expected outcome with at least an 80% chance of breaking even.

You are required:

- (a) to assess whether the decision was made in accordance with group guidelines,
- (b) to obtain what is the group attitude to risk as evidenced by the guidelines

Solution:

Situation	Demand	Probability	Contribution per unit	Probability	Total Contribution	Joint Probability	Cumulative Joint Probability
Selling Price ₹ 13.50							
Pessimistic	45,000	0.3	6.50	0.15	2,92,500	0.045	0.045
			7.00	0.65	3,15,000	0.195	0.240
			7.30	0.20	3,28,500	0.060	0.300
Most Likely	60,000	0.5	6.50	0.15	3,90,000	0.075	0.375
			7.00	0.65	4,20,000	0.325	0.700
			7.30	0.20	4,38,000	0.100	0.800
Optimistic	70,000	0.2	6.50	0.15	4,55,000	0.030	0.830
			7.00	0.65	4,90,000	0.130	0.960
			7.30	0.20	5,11,000	0.040	1.000
Selling Price ₹ 14.50							
Pessimistic	35,000	0.3	7.50	0.15	2,62,500	0.045	0.045
			8.00	0.65	2,80,000	0.195	0.240
			8.30	0.20	2,90,500	0.060	0.300

Situation	Demand	Probability	Contribution per unit	Probability	Total Contribution	Joint Probability	Cumulative Joint Probability
Most Likely	55,000	0.5	7.50	0.15	4,12,500	0.075	0.375
			8.00	0.65	4,40,000	0.325	0.700
			8.30	0.20	4,56,500	0.100	0.800
Optimistic	68,000	0.2	7.50	0.15	5,10,000	0.030	0.830
			8.00	0.65	5,44,000	0.130	0.960
			8.30	0.20	5,64,400	0.040	1.000

Last year's fixed costs = 75,000 units × ₹ 3 = ₹ 2,25,000

Estimated Fixed Costs	(₹)
₹ 2,25,000 × 1.10 × 0.2	49,500
₹ 2,25,000 × 1.25 × 0.5	1,40,625
₹ 2,25,000 × 1.50 × 0.3	1,01,250
	2,91,375

To break-even the contribution must be equal to or greater than ₹ 2,91,375. It is noticed from the above tables that at selling price of ₹ 13.50 there is 100% chance to break-even. However, at selling price of ₹ 14.50 there is 70% (0.075 + 0.325 + 0.1 + 0.03 + 0.13 + 0.04) chance of break-even. The selling price of ₹ 14.50, therefore, contravenes group guidelines.

Attitude to Risk: The group seeks to minimize the downside risk whilst maximizing its return. It is to some extent risk averse, but it is prepared to take some risk i.e., 20% risk of loss. It is always sought maximize its returns, ignoring the probability of failure, it would be risk neutral.

Terms to Master

- **Decision Making:** Decision making is the outcome resulting from the process of evaluation of the available alternatives and choosing the best.
- **Cost Behaviour:** Cost Behaviour refers to the changes in input costs in relation to the level of production.
- **Contribution:** Contribution is excess of the Sales Value over the Variable Cost.
- **Break Even Point (BEP):** Break Even Point is the point where 'Total Revenues' equal 'Total Costs'.
- **Margin of Safety:** Sales above the breakeven level reflect the Margin of Safety.
- **Product Differentiation:** Product Differentiation is the process of distinguishing a product or service from others, to make it more attractive to a particular target market.
- **Cost Leadership:** Cost Leadership Strategy aims at the firm winning market share by appealing to cost-conscious or price-sensitive customers.
- **Yield Management:** Yield Management is a set of revenue maximization strategies and tactics meant to improve the business profitability. It is a technique that determines the best pricing policy for optimising

profits. It is the art and science of price-driven and capacity-based profit maximization.

- **Transfer Price:** Transfer price is the notional value of goods and services transferred from one division to the other division of an organisation.
- **Relevant Costs:** Relevant Costs are costs which are relevant for a specific purpose or situation.
- **Irrelevant Costs:** Irrelevant costs are costs which are not relevant for a specific purpose or situation.
- **Target Costing:** Target Costing is considered as a philosophy in which product development is based on what the customer wants and is willing to pay for and not what it costs to produce.
- **Kaizen Costing:** kaizen Costing refers to the ongoing continuous improvement program that focuses on the reduction of waste in the production process, thereby further lowering costs below the initial targets specified during the design phase.
- **Product Life Cycle:** Product Life Cycle is a pattern of expenditure, sale level, revenue and profit over the period beginning from new idea generation to the deletion of product from product range.
- **Life Cycle Costing:** Life Cycle Costing is a system that is evolved to track and accumulate the costs and revenues attributable to a product or service from the stage of development to the stage of extinction.
- **Probability Distribution:** A probability distribution is a statistical function that describes all the possible values and likelihoods that a random variable can take within a given range.

Exercise

A. Theoretical Questions:

⊙ Multiple Choice Questions:

- The break-even point of a manufacturing company is ₹1,60,000. Fixed cost is ₹48,000. Variable cost is ₹12 per unit. The PV ratio will be:
 - 20%
 - 40%
 - 30%
 - 25%

Workings

$$\text{PV Ratio} = \text{FC} \div \text{BEP} = 48000 \div 160000 = 30\%$$

Explanatory Comment

Please remember that PV Ratio can be worked by dividing the contribution with sales or by dividing the fixed cost with BEP sales.

- The higher the actual hours worked,
 - The lower the capacity usage ratio.
 - The higher the capacity usage ratio.
 - The lower the capacity utilization ratio.
 - The higher the capacity utilization ratio.

Explanatory Comment

Capacity utilization ratio is worked out by dividing the actual hours with the budgeted hours. Therefore, higher the actual hours, higher would be the utilisation ratio.

- XYZ Ltd. has the following alternative planned activity levels.

Level	E	F	G
Total cost (₹)	1,00,000	1,50,000	2,00,000
No. of units produced	5000	10000	15000

If fixed overhead remains constant, then fixed overhead cost per unit at Level E is:

- ₹ 20
- ₹ 15
- ₹13.33
- ₹ 10

Workings

Level	E	F	G
Total cost (₹)	1,00,000	1,50,000	2,00,000

Level	E	F	G
No. of units produced	5000	10000	15000
Change in Total Cost		$(1,50,000 - 1,00,000) = 50,000$	$(2,00,000 - 1,50,000) = 50,000$
Change in units		$(10000-5000) = 5000$	$(15000-10000) = 5000$
Variable Cost per Unit (Change in TC ÷ Change in Units)		$(50,000 ÷ 5000) = 10$	$(50,000 ÷ 5000) = 10$
Total Variable Cost		$10,000 \times 10 = 1,00,000$	$15,000 \times 10 = 1,50,000$
Total Fixed Cost		$(TC - VC)$ $= (1,50,000 - 1,00,000)$ $= 50,000$	$(TC - VC)$ $= (2,00,000 - 1,50,000)$ $= 50,000$

Therefore, Fixed Cost at Level E also would be ₹50,000

Accordingly, Fixed Cost per unit at Level E = $(FC \div \text{No. of units}) = (50,000 \div 5,000) = ₹10$

Explanatory Comment

The problem is based on the fundamental principle that variable costs tend to vary in direct proportion to the level of activity whereas fixed costs tend to remain constant.

4. T Ltd. produces and sells a product. The company expects the following revenues and costs in 2018:
 Revenues (400 sets sold @ ₹600 per product) = ₹ 2,40,000
 Variable costs = ₹ 1,60,000
 Fixed costs = ₹ 50,000
 What amount of sales must T Ltd. have to earn a target net income of ₹63,000 if they have a tax rate of 30%?
- A. ₹ 4,20,000
 B. ₹4,29,000
 C. ₹3,00,000
 D. ₹4,89,000

Workings

Sales = ₹2,40,000

Variable Cost = ₹1,60,000

Contribution = $(2,40,000 - 1,60,000) = ₹80,000$

Contribution of Sales Ratio P.V. Ratio = $(80000 \div 240000) = 33.33\%$

Fixed Costs = ₹50,000

Profit Before Tax = $(80,000 - 50,000) = ₹30,000$

Target Net Income (TNI) = ₹ 63,000

Tax Rate (t) = 30%

Therefore, Target Profit Before Tax (TPBT) = $\{TNI \div (1-t)\} = \{63,000 \div (1-0.30)\} = (63,000 \div 0.70) = ₹90,000$

Target Contribution = (TPBT + FC) = (90,000 + 50,000) = ₹1,40,000

Target Sales = $\frac{\text{Target Contribution}}{\text{Contribution of Sales Ratio}} = (1,40,000 \div 33.33\%) = ₹4,20,000$

Explanatory Comment

The problem focuses on the aspects of deriving the target contribution on the basis of target profit before tax and then working out the sales by adopting the concept of C/S Ratio.

5. Excel Products Ltd. manufactures four products e.g. Product E, Product F, Product G and Product H using same raw materials. The input requirements for Products E, F, G and H are 1kg, 2kgs, 5kgs and 7kgs, respectively. Product-wise Selling Price and Variable Cost data are given hereunder:

Products	E	F	G	H
Selling Price (₹)	100	150	200	300
Variable Cost (₹)	50	70	100	125

Assuming raw material availability is a limiting factor, the correct ranking of the products would be:

- A. E, F, G & H
 B. E, F, H & G
 C. F, E, G & H
 D. F, E, H & G

Workings

Products	E	F	G	H
1. Selling Price (₹)	100	150	200	300
2. Variable Cost (₹)	50	70	100	125
3. Contribution (1 – 2)	50	80	100	175
4. Raw Material (Kg)	1	2	5	7
5. Contribution per Kg of Raw Material (3 ÷ 4)	50	40	20	25
6. Ranking (on the Basis of 5)	1	2	4	3

Therefore, correct order of ranking = E, F, H & G

Explanatory Comment

The problem demonstrates the application of the concept of contribution per unit of limiting factor while prioritizing the product preferences.

6. A company has a breakeven point when sales are ₹ 3,20,000 and variable cost at that level of sales are ₹ 2,00,000. How much would contribution margin increase or decrease if variable expenses are dropped by ₹30,000?
- A. Increase by 27.5%

- B. Increase by 9.375%
- C. Decrease by 9.375%
- D. Increase by 37.5%

Workings

Contribution = (Sales – Variable Costs) = (3,20,000 – 2,00,000) = ₹1,20,000

P.V. Ratio / C/S Ratio = $\{(Contribution \div Sales) \times 100\} = \{(1,20,000 \div 3,20,000) \times 100\} = 37.5\%$

Decrease in Variable Cost = ₹30,000

Revised Variable Cost = (2,00,000 – 30,000) = ₹1,70,000

Revised Contribution = (3,20,000 – 1,70,000) = ₹1,50,000

Revised C/S or P.V. Ratio = $\{(1,50,000 \div 3,20,000) \times 100\} = 46.875\%$

Increase in Contribution Margin = (46.875% - 37.5%) = 9.375%

7. The Tech Company has fixed costs of ₹400,000 and variable costs are 75% of the selling price. To realize profits of ₹100,000 from sales of 5,00,000 units, the selling price per unit
- A. must be ₹1.00
 - B. must be ₹4.80
 - C. must be ₹4.00
 - D. cannot be determined

Workings

Desired Profit = 1,00,000

Fixed Costs = 4,00,000

Desired Contribution = (1,00,000 + 4,00,000) = 5,00,000

PV Ratio = 25%

Desired Sales = (Contribution ÷ PV Ratio)
= (5,00,000 ÷ 25%) = 20,00,000

Number of Units = 5,00,000

Selling Price per Unit = (20,00,000 ÷ 5,00,000) = ₹4/-

8. A company makes components and sells internally to its subsidiary and also to external market. The external market price is ₹24 per component, which gives a contribution of 40% of sales. For external sales, variable costs include ₹1.50 per unit for distribution costs. This is, however not incurred in internal sales. There are no capacity constraints. To maximize company profit, the transfer price to subsidiary should be:
- A. ₹9.60
 - B. ₹12.90
 - C. ₹14.40
 - D. None of these

Workings

$$\begin{aligned}\text{Transfer Price} &= \text{Marginal Cost} - \text{Opportunity Gain} \\ &= ₹24 \times 60\% - ₹1.50 \\ &= 14.40 - 1.50 = ₹12.90.\end{aligned}$$

9. H Group has two divisions, Division P and Division Q. Division P manufactures an item that is transferred to Division Q. The item has no external market and 6000 units produced are transferred internally each year. The costs of each division are as follows:

	Division P	Division Q
Variable Cost (₹)	100 per unit	120 per unit
Fixed cost each year (₹)	1,20,000	90,000

Head Office management decided that a transfer price should be set that provides a profit of ₹ 30,000 to Division P. What should be the transfer price per unit?

- A. ₹ 145
B. ₹ 125
C. ₹ 120
D. ₹ 135

Workings

For Division P

Target Profit = ₹30,000

Fixed Cost = ₹1,20,000

Target Contribution = (30,000 + 1,20,000) = 1,50,000

Target Contribution per unit = 1,50,000 ÷ 6000 = 25

Target Sale Price per unit = (Target Contribution + Variable Cost)
= (25 + 100) = ₹125

10. A particular job required 800 kgs of material – P. 500 kgs. of the particular material is currently in stock. The original price of the material – P was ₹300 but current resale value of the same has been determined as ₹200. If the current replacement price of the material – P is ₹0.80 per kg., the relevant cost of the material – P required for the job would be:
- A. ₹640
B. ₹440
C. ₹300
D. None of these

Workings:

Particulars	₹
500 kgs of material in stock at resale value	200

Particulars	₹
Balance 300 kgs of material at current price of ₹0.80	240
Relevant Cost of the Material	440

11. What is the opportunity cost of making a component part in a factory given no alternative use of the capacity?
- The variable manufacturing cost of the component
 - The total manufacturing cost of the component
 - The total variable cost of the component
 - Zero

Explanatory Comment:

Opportunity Cost is the “cost” incurred by not enjoying the benefit associated with the best alternative choice. In the instant case there is no (zero) alternative use for the capacity. Hence, answer (D) is correct.

12. If project A has a net present value (NPV) of ₹30,00,000 and project B has an NPV of ₹50,00,000, what is the opportunity cost if project B is selected?
- ₹23,00,000
 - ₹30,00,000
 - ₹20,00,000
 - ₹50,00,000

Explanatory Comment:

Opportunity cost represents the next best alternative foregone. If B is chosen, only A is being foregone and hence the NPV of ₹30,00,000 is the Net present value of the opportunity lost.

13. X Ltd. has 1000 units of an obsolete item which are carried in inventory at the original price of ₹50,000. If these items are reworked for ₹20,000, they can be sold for ₹36,000. Alternatively, they can be sold as a scrap for ₹6,000 in the market. In a decision model used to analyse the reworking proposal, the opportunity cost should be taken as:
- ₹16,000
 - ₹6,000
 - ₹30,000
 - ₹20,000

Workings

Original price of ₹50,000 is not relevant.

Rework income = ₹36,000

Less: Cost of rework = ₹20,000

Net Inflow = ₹16,000 which is relevant.

The other alternative, relevant for cash flow, is from sale as scrap, i.e.. ₹6,000

Hence the opportunity cost is ₹6,000

Explanatory Comment:

Next best alternative for net inflow is sale as scrap which gives an income of ₹6,000. Therefore, Opportunity cost is ₹6,000

14. The shadow price of skilled labour for SD Ltd. is currently ₹10 per hour. What does this mean?
- The cost of obtaining additional skilled labour is ₹10 per hour.
 - There is a hidden cost of ₹10 for each hour of skilled labour actively worked.
 - Contribution will be increased by ₹10 per hour for each extra hour of skilled labour that can be obtained.
 - The total costs will be reduced by ₹10 for each additional hour of skilled labour that can be obtained.

Explanatory Comment:

A shadow price for a scarce resource is its opportunity cost. It is the amount of contribution that would be lost if one unit less of that resource were available. It is similarly the amount of additional contribution that would be earned if one unit more of that resource were available. (This is on the assumption that that the scarce resource is available at its normal variable cost).

15. A factory can make only one of the three products X, Y or Z in a given production period. The following information is given:

Per unit ₹	X	Y	Z
Selling Price	1500	1800	2000
Variable Cost	700	950	1000

Assume that there is no constraint on resource utilization or demand and similar resources are consumed by X, Y and Z. The opportunity cost of making one unit of Z is:

- ₹850
- ₹800
- ₹1,800
- ₹1,500

Workings:

(Amount in ₹)

Serial	Particulars	X	Y	Z
1	Selling Price	1500	1800	2000
2	Variable Cost	700	950	1000
3	Contribution (1-2)	800	850	1000
4	Ranking	3	2	1

Explanatory Comment:

Next best alternative for Z is Y which gives a contribution of ₹850 (Higher amount X and Y). Therefore, Opportunity cost of Z = ₹850.

16. A company has 2000 units of an obsolete item which are carried in inventory at the original purchase

price of ₹30,000. If these items are reworked for ₹10,000, they can be sold for ₹18,000. Alternatively, they can be sold as scrap for ₹3,000 in the market. In a decision model used to analyse the reworking proposal, the opportunity cost should be taken as:

- A. ₹8,000
- B. ₹12,000
- C. ₹3,000
- D. ₹10,000

Workings

(i) Original price is not relevant

(ii) Net Inflow from Rework (₹)

A. Rework Income	18,000
B. Deduct cost of rework	10,000
Net Inflow (A – B)	8,000 It is relevant

The other alternative relevant for cash flow is from sale as scrap = ₹3,000 Hence, the opportunity cost is ₹3,000 for the Reworking Proposal.

17. TM Company can make 100 units of a necessary component part with the following costs (₹)

Direct Materials 60,000

Direct Labour 10,000

Variable Overhead 30,000

Fixed Overhead 20,000

TM Company can purchase the component externally for ₹1,10,000 and only ₹5,000 of the fixed costs can be avoided, what is the correct make-or-buy decision?

- A. Make and Save ₹5000
- B. Buy and save ₹5,000
- C. Make and Save ₹1,5000
- D. Buy and save ₹15,000

Workings

$$\begin{aligned} \text{Variable Costs of Making} &= (\text{Direct Materials} + \text{Direct Labour} + \text{Variable Overhead}) \\ &= (60,000 + 10,000 + 30,000) \\ &= ₹ 1,00,000 \end{aligned}$$

$$\text{Hence, cost of making} = ₹ 1,00,000$$

$$\begin{aligned} \text{Cost of Buying} &= (\text{Buying Costs} - \text{Avoidable Fixed Costs}) \\ &= (1,10,000 - 5,000) \\ &= ₹ 1,05,000 \end{aligned}$$

$$\begin{aligned} \text{Make and Save} &= (1,05,000 - 1,00,000) \\ &= ₹5,000 \end{aligned}$$

18. AP Products sells product A at a selling price of ₹40 per unit. Ap's cost per unit based on the full capacity of 5,00,000 units is as follows:

Direct Materials	6
Direct Labour	3
Indirect Manufacturing Expense 60% of which is fixed	10
Total	19

A one-time only special order offering to buy 50,000 units was received from an overseas distributor. The only other costs that would be incurred on this order would be ₹ 4 per unit for shipping. AP has sufficient existing capacity to manufacture the additional units. In negotiating a price for the special order, AP should consider that the minimum selling price per unit should be

- A. ₹ 17
B. ₹ 19
C. ₹ 21
D. ₹ 23

Workings

Relevant Costs for the Special Order

Direct Materials = ₹6

Direct Labour = ₹3

40% of Indirect Manufacturing Expense = 4

Shipping Costs = ₹4

Total = (6 + 3 + 4 + 4) = ₹17

19. In cost plus pricing, the markup consist of
- A. Manufacturing cost
B. Desired ROI
C. Selling and administrative cost
D. Total cost and desired ROI
20. MN paid ₹ 5,30,000 for a machine used to powder wheat. The machine can be sold for ₹ 1,30,000. The sale value of wheat is ₹ 8,00,000 and its variable cost is ₹ 4,00,000. The opportunity cost of producing wheat flour is
- A. ₹530,000
B. ₹1,30,000
C. ₹3,50,000
D. ₹ 8,00,000

Explanatory Comment:

The next best alternative to producing wheat flour is selling the machine i.e.. for ₹ 1,30,000, which is the opposite cost of producing wheat.

21. A Ltd. Plans to introduce a new product and issuing the target cost approach. Projected sales revenue is ₹90,00,000 (₹45 per unit) and target costs are ₹64,00,000. What is the desired profit per unit?
- ₹13
 - ₹17
 - ₹32
 - ₹10

Workings

Sales Revenue	= ₹90,00,000
Price per Unit	= ₹45
Number of Units	= (90,00,000 ÷ 45) = 2,00,000
Target Costs	= ₹64,00,000
Cost per Unit	= (64,00,000 ÷ 2,00,000) = ₹32
Desired Profit per Unit	= (45 – 32) = ₹13

22. Target costing is the answer to
- Market driven prices
 - Sellers' market
 - No Profit situation
 - None of the above
23. The product of XYZ company is sold at a fixed price of ₹1,500 per unit. As per company's estimate, 500 units of the product are expected to be sold in the coming year. If the value of investments of the company is ₹15 lakhs and it has a target ROI of 15%, the target cost would be:
- ₹930
 - ₹950
 - ₹1050
 - ₹1130

Workings

Target ROI at 15% of total investment of ₹15 lakhs	= ₹15,00,000 × 0.15
	= ₹ 2,25,000
Expected output	= 500 units
Target Profit per unit of output	= ₹ 2,25,000/500
	= ₹450 per unit
Target cost per unit	= Selling Price – Profit per unit
	= ₹ 1,500 – ₹ 450
	= ₹ 1,050 per unit.

24. A company has the capacity of producing 80000 units and presently sells 20000 units at ₹ 100 each. The demand is sensitive to selling price and it has been observed that with every reduction of ₹ 10 in selling price the demand is doubled. What should be the target cost if the demand is doubled at full capacity and profit margin on sale is taken at 25%?

- A. ₹75
- B. ₹90
- C. ₹25
- D. ₹60

Workings:

Particulars	Price (₹)	Demand (Units)
As at present	100	20,000
Reduction of price by ₹ 10	(100 – 10) 90	(20,000 × 2) 40,000
Reduction of price by another ₹ 10	(90 – 10) 80	80,000 (Full Capacity (40,000 × 2))

Therefore, at full capacity of 80,000 units:

Selling Price = ₹80
 Target Profit = 25% of Selling Price
 = 25% of 80
 = ₹20
 Target Cost = (Selling Price – Profit)
 = (80 – 20)
 = ₹60

Answer:

1	C	2	D	3	D	4	A	5	B	6	B
7	C	8	B	9	B	10	B	11	D	12	B
13	B	14	C	15	A	16	C	17	A	18	A
19	B	20	B	21	A	22	A	23	C	24	D

⊙ **Essay Type Questions**

1. Define and discuss decision making process.
2. State the relevance of cost behaviour in the context of choosing the best alternative.
3. Write a note on key factor analysis.
4. What are the key pricing strategies? Elaborate with examples.
5. List the merits and de-merits of product differentiation.

6. Explain the concept of cost leadership with the help of a case study.
7. What are the key features of Yield Management?
8. What are the key features of industries that are amenable to Yield Management?
9. What are the benefits of Transfer pricing? What are the prevalent methods in determining transfer price?
10. Distinguish between Relevant Costs and Irrelevant Costs.
11. Discuss the philosophy of Target Costing. Highlight its key features.
12. Narrate the process of Target Costing.
13. Write a note on product life cycle.
14. What do you understand by life cycle costing?
15. Highlight the utility of probability in decision making.

Abbreviations

ABCM	Activity Based Cost Management
BEP	Break Even Point
CRM	Customer Relationship Management
EV	Expected Value
JIT	Just-In-Time
LCC	Life Cycle Cost
MRP	Materials Requirements Planning
PLC	Product Life Cycle
PLCC	Product Life Cycle Costing
PV Ratio	Profit Volume Ratio
PPP	People, Planet, Profit
TQM	Total Quality Management
TP	Transfer Pricing
YM	Yield Management

