Cost Volume Profit Analysis

- **Cost Drivers**
- Variable & Fixed Cost Behaviour
- **Difficulties in classifying cost**
- **Break Even Point**
- Margin of Safety
Cost-Volume-Profit Assumptions and Terminology

1. Changes in the level of revenues and costs arise only because of changes in the number of product (or service) units produced and sold.

2. Total costs can be divided into a fixed component and a component that is variable with respect to the level of output.
MARGINAL COSTING

Marginal costing is not a system of costing, but it is a special technique concerned particularly with the effect, which fixed overhead has on the running of a business and this technique is extensively used in all industries for profit planning, cost control and decision-making.

Marginal cost is the amount at any given volume of output by which aggregate costs are changed if the volume of output is increased or decreased by one unit. Under the marginal costing system, costs are classified under fixed cost and variable cost. **Marginal cost is, the total variable cost** (i.e. Direct Materials, Direct Labour, Direct Expenses and variable overheads) because within the capacity of the organization, an increase of one unit in production will cause and increase in variable cost only.
Abbreviations

- **SP** = Selling price
- **VCU** = Variable cost per unit
- **C** = Contribution per unit
- **P/V Ratio** = Contribution margin percentage
- **F** = Fixed costs
CONTRIBUTION

- Contribution is the difference between the sales and the marginal cost of sales and it contributes towards fixed expenses and profit. Thus, contribution will first go to meet fixed expenses and then to earn profit.

- \[ \text{CONTRIBUTION} = \text{SELLING PRICE} - \text{MARGINAL COST} = \text{FIXED EXPENSES} + \text{PROFIT} \]
Contribution margin percentage (contribution margin ratio) is the contribution margin per unit divided by the selling price.
PROFIT VOLUME RATIO

- This term is important for studying the profitability of operating of a business. Profit volume ratio establishes a relationship between contribution and the sales value. The concept of P/V Ratio helps in determining Break Even Point, Profit at any volume of sales, sales required to earn a desired quantum of profit, profitability of products process or departments etc. Management always tries to increase the P/V Ratio of each product.

\[ P/V Ratio = \frac{Contribution}{Sales} \times 100 \]

- If Sales value and P/V Ratio are given, contribution for any amount of estimated sales can be ascertained as under:

\[ Contribution = Sales Value \times P/V Ratio = Fixed Expenses + Profit \]
To find out estimated value of sales with the help of contribution and P/V Ratio

\[
Sales\ Value = \frac{\text{Contribution}}{P/V\ Ratio} \quad \text{OR} \quad \frac{\text{Fixed Expenses} + \text{Desired Profit}}{P/V\ Ratio}
\]
A business is said to break even when its total sales are equal to its total costs. A break even point is that volume of sales or production where there is no profit and no loss. At this point contribution is just equal to fixed expenses. If production is enhanced beyond this level, profit shall accrue to the management, and if it is decreased from this level, loss shall be suffered by the organization.

\[
B.E.P.\text{ (in units)} = \frac{\text{Fixed Expenses}}{\text{Contribution per unit}}
\]

\[
B.E.P.\text{ (in value)} = \frac{\text{Fixed Expenses}}{P/V\text{Ratio}}
\]
Breakeven Point

\[ \text{Total revenues} = \text{Total costs} \]

- Sales
- Variable expenses
- Fixed expenses
CALCULATION OF OUTPUT OR SALES VALUE AT WHICH A PROFIT IS EARNED

\[
\frac{Fixed \text{ Expenses} + Profit}{Contribution \text{ per Unit}} = \frac{Fixed \text{ Expenses} + Profit}{Profit \text{ Volume Ratio} (P/VRatio)}
\]

The following formulae may be used in order to ascertain profit:

(i) \(Profit = Sales - (Variable Cost + Fixed Cost)\) OR
(ii) \(Profit = (Sales \times P/V Ratio) - Fixed Cost\)

Calculation of Selling Price per unit for a particular B.E.P.:

\[
Selling \text{ Price per unit} = \frac{Fixed \text{ Cost}}{Desired \text{ BEP in Units}} + Unit \text{ Variable Cost}
\]
Graph Method

- **Breakeven**
- Revenue
- Total costs
- Fixed costs

**Units**

0 1000 2000 3000 4000 5000

**Graph Method**
Equation Method

(Selling price × Quantity sold) – (Variable unit cost × Quantity sold) – Fixed costs = Operating income
Calculation of Additional Volume required to meet proposed expenditure

\[ \text{In Units} = \frac{\text{Proposed Expenditure}}{\text{Contribution per unit}} \quad \text{OR} \]

\[ \text{In Value} = \frac{\text{Proposed Expenditure}}{PV \text{ Ratio}} \]
Businessmen always try to know how much they are above the break-even point. This is technically called margin of safety and is calculated by sales or production units at the selected activity and the break even sales or production. A large margin of safety indicates the soundness of the business. Margin of safety can be improved by lowering fixed and variable costs, increasing volume of sales or selling price and changing product mix so as to improve contribution and overall P/V Ratio.

Margin of Safety (in Value) = Total Sales (-) Sales at B.E.P.
Margin of Safety

\[ M \text{ arg in of Safety} = \frac{\text{Profit}}{P/V \text{ Ratio}} \]

Or

\[ \frac{\text{Profit}}{C \text{ perUnit}} \]

- Margin of safety (in Units) = Total Sales in units (-) B.E.P. Sales in units or

\[ M \text{ arg in of Safety in %} = \frac{\text{Total Sales}(-)B.E.P.Sales}{\text{Total Sales}} \times 100 \]
Calculation of Sales Volume required to set off Price Reduction:

\[ Sales\ Needed\ (Units) = \frac{Fixed\ Cost + Present\ Profit}{New\ Contribution\ per\ Unit} \ OR \]
\[ Sales\ Needed\ (Value) = \frac{Fixed\ Cost + Present\ Profit}{NewP/VRatio} \]

**ANGLE OF INCIDENCE**

The angle formed by the sales line and the total cost lines at the break-even point is known as angle of incidence. A high rate of profit is indicated by a large angle of incidence and vice versa.

**APPLICATION OF MARGINAL COSTING**

- (i) Fixing Selling Price
- (ii) Effect of reduction of selling price
- (iii) Determination of optimum output
- (iv) Exploring foreign market
Target Operating Income

\[(\text{Fixed costs} + \text{Target operating income}) \text{ divided either by Contribution margin percentage or Contribution margin per unit}\]
QUESTION 1

The Acme Company produces and sells one product. The revenue and cost structure of the product is given below:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount in S.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price Per Unit</td>
<td>10.00</td>
</tr>
<tr>
<td>Variable Cost Per Unit</td>
<td>6.00</td>
</tr>
<tr>
<td>Total Fixed Cost per year</td>
<td>1,00,000</td>
</tr>
</tbody>
</table>

COMPUTE THE BREAK EVEN VOLUME IN UNITS AND RUPES
ANSWER 1

\[ C = S - V = 10 - 6 = 4 \]

\[ \text{B.E.P. in Units} = \frac{\text{Fixed Expenses}}{C \text{ per unis}} = \frac{1,00,000}{4} = 25,000 \text{ units} \]

\[ \text{P.V. Ratio} = \frac{C}{S} \times 100 = \frac{4}{10} \times 100 = 40\% \]

\[ \text{B.E.P. in Amount} = \frac{\text{Fixed Expenses}}{P / V \text{ Ratio}} = \frac{1,00,000}{40\%} = 2,50,000 \]
Calculate break even point on the basis of the following information supplied by a manufacturing firm:

<table>
<thead>
<tr>
<th>PARTICULARS</th>
<th>AMOUNT IN S.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESTIMATED SALES</td>
<td>10,00,000</td>
</tr>
<tr>
<td>ESTIMATED VARIABLE COSTS</td>
<td>6,00,000</td>
</tr>
<tr>
<td>ESTIMATED FIXED COSTS</td>
<td>2,00,000</td>
</tr>
</tbody>
</table>
ANSWER 2

\[ C = S - V = 10,00,000 - 6,00,000 = 4,00,000 \]

\[ P.V. Ratio = \frac{C}{S} \times 100 = \frac{4,00,000}{10,00,000} \times 100 = 40\% \]

\[ B.E.P. in Amount = \frac{Fixed Expenses}{P/V Ratio} = \frac{2,00,000}{40\%} = 5,00,000 \]
QUESTION 3

Following information are available about a company:

Fixed Overheads for the year amounted to 20,000 S.R.. Sales and production was of 10,000 units. You are to find:

i. Marginal Cost
ii. Contribution per unit
iii. Variable cost
iv. Total Contribution
v. Net Profit

<table>
<thead>
<tr>
<th>COST PER UNIT</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAW MATERIALS</td>
<td>25</td>
</tr>
<tr>
<td>LABOUR</td>
<td>10</td>
</tr>
<tr>
<td>VARIABLE OVERHEADS</td>
<td>5</td>
</tr>
<tr>
<td>SELLING PRICE</td>
<td>50</td>
</tr>
</tbody>
</table>
Answer 3

1. Marginal Cost = Mat + Labour + Variable Overheads = 25 + 10 + 5 = 40
2. Contribution per unit = $ - M.C. = 50 - 40 = 10
3. Total Variable Cost = 40 x 10,000 = 40,00,000
4. Total Contribution = C x Units = 10 x 10,000 = 1,00,000
5. Net Profit = Total Contribution – Fixed Overhead = 1,00,000 – 20,000 = 80,000
The Price structure of a cycle made by the Cycle Company Ltd. is as follows:

<table>
<thead>
<tr>
<th>PARTICULARS</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIALS</td>
<td>60</td>
</tr>
<tr>
<td>LABOUR</td>
<td>20</td>
</tr>
<tr>
<td>VARIABLE OVERHEADS</td>
<td>20</td>
</tr>
<tr>
<td>FIXED OVERHEADS</td>
<td>50</td>
</tr>
<tr>
<td>PROFIT</td>
<td>50</td>
</tr>
<tr>
<td>SELLING PRICE</td>
<td>200</td>
</tr>
</tbody>
</table>

This is based on the manufacture of 1,000,000 cycles per annum. This company expects due to competition they will have to reduce selling price, but they want to keep the total profits intact. What level of production will have to be reached, i.e. how many cycles will have to be manufactured to get the same amount of profit, if:

i. The selling price is reduced by 10%  
ii. The selling price is reduced by 20%
ANSWER 4

Present Profit = 100000 x 50 = 50,00,000

Present S.P.=200

New S.P. after 10% Reduction = \(200 \times \frac{90}{100} = 180\)

New S.P. after 20% Reduction = \(200 \times \frac{80}{100} = 160\)

\[C = S - V = 180 - 100 = 80\]

Required Sales to earn same amount of Profit = \(\frac{F + P}{C} = \frac{50,00,000 + 50,00,000}{80} = \frac{1,00,00,000}{80} = 1,25,000 \text{ cycles}\)

\[C = S - V = 160 - 100 = 60\]

\[\frac{1,00,00,000}{60} \text{ cycles} = 1,66,667\]
### QUESTION 5

Given the following figures:

<table>
<thead>
<tr>
<th>PARTICULARS</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXED COSTS</td>
<td>16,000</td>
</tr>
<tr>
<td>SELLING PRICE PER UNIT</td>
<td>8</td>
</tr>
<tr>
<td>VARIABLE COST PER UNIT</td>
<td>5</td>
</tr>
</tbody>
</table>

Show the impact of the following changes on break even point:

- **i.** Fixed Cost increase by 5,000 S.R.
- **ii.** Decrease in Fixed Costs by 4,000 S.R.
- **iii.** 20% increase in variable cost
- **iv.** Fixed Cost increase by 20% and variable costs decreased by 10%
Answer 5

**Present B.E. P.inUnits**

\[ \frac{F}{C} = \frac{16,000}{3} = 5,333 \text{ units} \]

Effect of increase in Fixed Costs by 5,000, Now Total Fixed Expenses = 16,000+5,000 = 21,000

**New B.E. P.inUnits**

\[ \frac{F}{C} = \frac{21,000}{3} = 7,000 \text{ units} \]

Effect of decrease in Fixed Cost by 4,000, Now Fixed Expenses =16,000 - 4,000 = 12,000

**New B.E. P.inUnits**

\[ \frac{F}{C} = \frac{12,000}{3} = 4,000 \text{ units} \]
Effect of increase in variable cost by 20%
V.C. = 5 + 1 = 6, New C will be 8 – 6 = 2

\[
\text{New B.E. P.inUnits} = \frac{F}{C} = \frac{16,000}{2} = 8,000 \text{ units}
\]
QUESTION 6

The total cost and profits during two period were as follows:

<table>
<thead>
<tr>
<th>PARTICULARS</th>
<th>PERIOD –I</th>
<th>PERIOD – II</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMOUNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL COST</td>
<td>4,00,000</td>
<td>6,50,000</td>
</tr>
<tr>
<td>PROFIT</td>
<td>50,000</td>
<td>1,00,000</td>
</tr>
</tbody>
</table>

Calculate:

i. P/V Ratio
ii. Break Even Sales
iii. Sales required to earn a profit of 1,25,000 S.R.
iv. Profit earned when sales are 3,50,000 S.R.
Answer 6

\[ P/V \text{ Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{50000}{250000} \times 100 = 20\% \]

\[ \text{Fixed Expenses} = \text{Sales} \times P/V \text{ Ratio} - \text{Profit} = 500000 \times 20\% - 50000 = 50,000 \]

\[ \text{B.E.P. Sale} = \frac{F}{P/V \text{ Ratio}} = \frac{50000}{20\%} = 2,50,000 \]

\[ \text{Sales to earn a Profit} \quad 1,25,000 = \frac{\text{Fixed Expenses} + \text{Desired Profit}}{P/V \text{ Ratio}} = \frac{50,000 + 1,25,000}{20\%} = 8,75,000 \]

\[ \text{Profit when Sales are} \quad 3,50,000 = \]

\[ \text{Profit} = (\text{Sales} \times P/V\text{Ratio}) - \text{Fixed Cost} = 3,50,000 \times 20\% - 50,000 = 20,000 \]
XY Co. Sold in two successive years 7,000 and 9,000 units and incurred a loss of 10,000 S.R. and earned 10,000 as profit respectively. The selling price per unit is 100 S.R.

Calculate (a) the amount of fixed costs, (b) the number of units to break even, and (c) the number of units to earn a profit of 50,000 S.R.
ANSWER 7

\[ P/V \, Ratio = \frac{Change \ in \ Profit}{Change \ in \ Sales} \times 100 = \frac{20,000}{2,000,000} \times 100 = 10\% \]

The amount of Fixed Cost:
Contribution of First Year 10% of 7,00,000 = 70,000 + Loss during the year 10,000 = 80,000

\[ B.E.P. = \frac{Fixed \ Cost}{P/V \ Ratio} = \frac{80,000}{10\%} = 8,00,000 \]

\[ B.E.P. \, in \, Units = \frac{Total \ Sales}{S.P. \ per \ unit} = \frac{8,00,000}{100} = 8,000 \, units \]
Contd.

\[
\text{Required Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{80,000 + 50,000}{10\%} = 13,000,000
\]

\[
\text{B.E.P. in Units} = \frac{\text{Total Sales}}{\text{S.P. per unit}} = \frac{13,000,000}{100} = 13,000 \text{ units}
\]
Question 8

- Fixed Expenses = 20,000, Variable Cost per unit 10, Selling Price Unit = 20, Calculate profit when sales will be 2,00,000.

Answer

\[
P/V Ratio = \frac{C}{S} \times 100 = \frac{10}{20} \times 100 = 50\%
\]

\[
Profit = (Sales \times P/V Ratio) - Fixed Expenses = 2,00,000 \times \frac{50}{100} - 20,000 = 80,000
\]
Question 9

Given:
P/V Ratio = 30%, Total Turnover = 50,000 S.R.
Find out Contribution

Answer:

\[ \text{Contribution} = Sales \times P/V \text{ Ratio} = 50,000 \times \frac{30}{100} = 15,000 \]
Fixed Expenses = 20,000, Variable Cost per unit 10, Selling Price Unit = 20, Calculate the required sales if profit target of Rs. 60,000 has been budgeted.
Answer 10

\[ C = S - V = 20 - 10 = 10 \]

Required Sales to earn 60,000 amount of Profit = \( \frac{F + P}{C} = \frac{20,000 + 60,000,000}{10} \)

\[ \frac{80,000}{10} = 8000 \text{ units} \]

\[ C = S - V = 20 - 10 = 10 \]

\[ P/V \text{ Ratio} = \frac{C}{S} \times 100 = \frac{10}{20} \times 100 = 50\% \]

Required Sales to earn 60,000 amount of Profit = \( \frac{F + P}{P/V \text{ Ratio}} = \frac{20,000 + 60,000,000}{50\%} \)

\[ \frac{80,000}{50} \times 100 = 1,60,000 \]
QUIZ No. 5
COST VOLUME PROFIT ANALYSIS
ATTEMPT ALL QUESTIONS

1. For measuring and forecasting the profits of a business the financial experts use the technique of _______________________.

Cost Volume Profit Analysis

2. The Cost volume Profit Analysis is also helpful for the firm in understanding and analyzing the effects on profit with changes in _________ and _________ and ____________ of sales.

Cost    Price    volume

3. The B.E.P. is that level of production in a firm where total sales value is more than the total costs. True  False
4. Write the correct B.E.P. Equation:
   \[ S - V = F + P \]
5. What does stand for in Marginal Costing:
   - \[ F = \]
   - \[ V = \]
   - \[ C = \]
   - \[ P/V \text{ Ratio} = \]
6. The difference between B.E.P. Sales and Actual Sales is called Margin of Safety. True    False
   - False
QUIZ-5

7. Write the formula of Margin of Safety in percentage form:

Ans. \[ \text{Margin of Safety (in % of Sales)} = \frac{\text{Sales} - \text{BEPSales}}{\text{Sales}} \times 100 \]

8. In the business, as the margin of safety increase the chances of loss of business decreases. True False

True

9. Write the formula for calculation of Sales Volume to earn desired profit:

Ans. \[ \text{Desired Sales (in units)} = \frac{\text{Total FixedCost} + \text{Desired Profit}}{\text{Contribution Per Unit}} \]
10. To improve the Profit Volume Ratio:
   i. Increase in Selling price
   ii. Decrease in Variable costs
   iii. Change in Sales Mix
   iv. All the above

Ans. All the above.
1. What is meant by the term ‘cost-profit volume analysis? Also explain the Break-even Point. How is it calculated?

2. What do you mean by Profit Volume Ratio? How does it help in profit planning? Explain with appropriate illustrations.