

BAFS

Course Title: Cost Accounting for Decision Making

Professional Development Programme on Enriching
Knowledge of the Business, Accounting and Financial Studies
(BAFS) Curriculum <Elective Part>

Learning Outcomes

Upon completion of this course, teacher participants should be able to:

- apply cost-volume-profit analysis techniques to ascertain the inter-relationships among costs, selling price, units sold, breakeven point, target profit and margin of safety;
- state the assumptions and limitations of cost-volume-profit analysis;
- identify and differentiate relevant costs and irrelevant costs in different business scenarios; and
- make recommendation to short-term business decisions.

Syllabus in HKDSE Examination

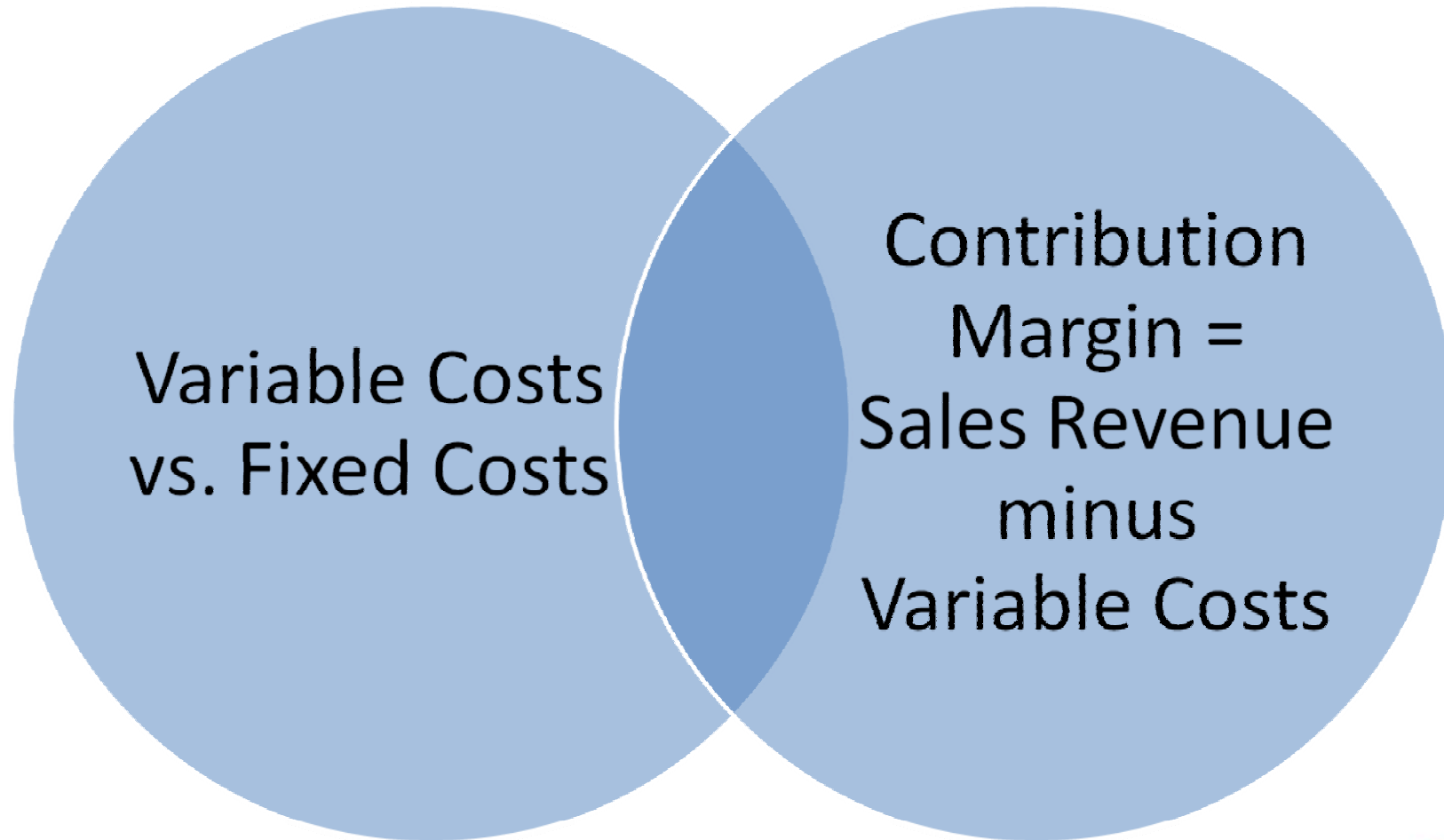
- **Identify** the nature of various **cost items** and their relevance to decision-making: sunk costs, incremental costs and opportunity costs.
- **Apply** costing concepts and techniques in **business decisions**, e.g. “hire, make or buy”, “accept or reject an order at a special price”, “retain or replace equipment”, “sell or process further” and “eliminate or retain an unprofitable segment”.
- **Conduct cost-volume-profit analysis** to assess the **effects of changes** in costs, selling price and units sold on the **breakeven point** and **target profit**.

← What-if analysis

Contents

- Breakeven point
- Sale level required to achieve target profit
- Margin of safety
- What-if analysis (Illustrations 1 & 2)
- Sales mix (Illustration 3 & 4)
- Relevant costs vs. irrelevant costs (Illustrations 5 & 6)
- Accept or reject an order (Illustration 7)
- Hire decision (Illustration 8)
- Make or buy (illustration 9)
- Retain or replace equipment (Illustration 10)
- Sell or process further (Illustration 11)
- Eliminate or retain an unprofitable segment (Illustration 12)

Prior Knowledge Required



Cost-Volume-Profit Analysis (C-V-P Analysis) (Breakeven Analysis)

What is it?

- Breakeven = no profit, or loss, that is,
 - Total Sales Revenue = Total Costs (Variable Costs + Fixed Costs)
 - Total Contribution = Fixed Costs
- It studies how cost, revenue and production/sales volume affect profit
- Two approaches:
 - By Formula
 - By Graph

Breakeven Point – By Formula

$$\text{Breakeven Point (in units)} = \frac{\text{Fixed Costs}}{\text{Unit Contribution}}$$

$$\text{Breakeven Point (in \$)} = \frac{\text{Fixed Costs}}{\text{Unit Contribution}} \times \text{Unit Selling Price}$$

or
$$\text{Breakeven Point (in \$)} = \frac{\text{Fixed Costs}}{\text{Contribution Margin Ratio}}$$

where
$$\text{Contribution Margin Ratio} = \frac{\text{Unit Contribution}}{\text{Unit Selling Price}}$$

Sales Level Required to Achieve Target Profit

$$\text{Sales Level (in units)} = \frac{\text{Fixed Costs} + \text{Target Profit}}{\text{Unit Contribution}}$$

$$\text{Sales Level (in \$)} = \frac{\text{Fixed Costs} + \text{Target Profit}}{\text{Unit Contribution}} \times \text{Unit Selling Price}$$

or
$$\text{Sales Level (in \$)} = \frac{\text{Fixed Costs} + \text{Target Profit}}{\text{Contribution Margin Ratio}}$$

Margin of Safety – By Formula

Margin of Safety (in units)

$$\begin{aligned} &= \text{Actual or Budgeted Sales (in units)} \\ &- \text{Breakeven Point Sales (in units)} \end{aligned}$$

Margin of Safety (in \$)

$$\begin{aligned} &= \text{Actual or Budgeted Sales (in \$)} \\ &- \text{Breakeven Point Sales (in \$)} \end{aligned}$$

$$\text{Margin of Safety Ratio (in \$)} = \frac{\text{Profit}}{\text{Contribution Margin Ratio}}$$

Margin of Safety Ratio (in %)

$$= \frac{\text{Margin of Safety (in units or in \$)}}{\text{Actual or Budgeted Sales (in units or in \$)}} \times 100\%$$

What-if Analysis

- It studies how the result will change if the original data changes.
- It answers questions such as:
 - What will be the breakeven point if variable cost per unit increased by 5%?
 - What will be the profit if sales volume increases by 5%?

Effects of Changes in Costs, Selling Price on the Breakeven Point

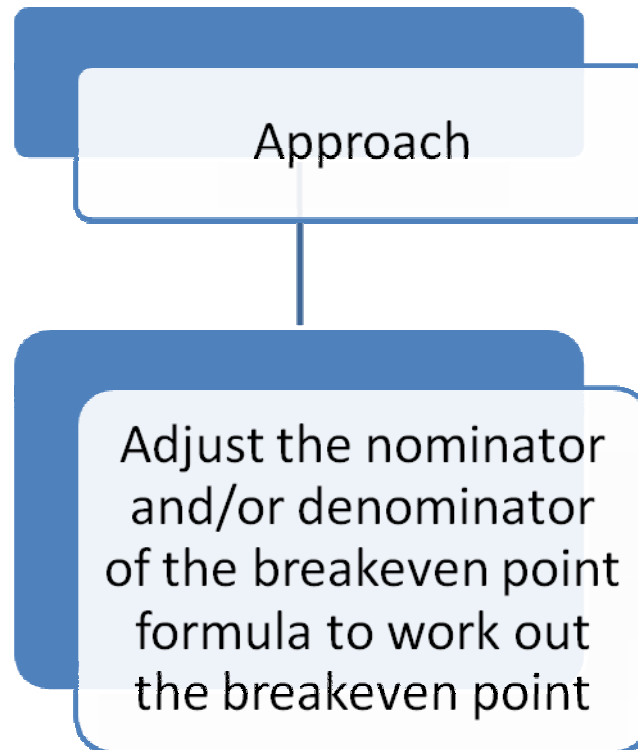


Illustration 1

Effect of Changes in Costs on Breakeven Point

- A manufacturing company produces and sells a single product as follows:

Selling price per unit	\$250
Variable costs per unit	\$150

- The fixed cost per annum is estimated to be \$600,000.

Illustration 1

Effect of Changes in Costs on Breakeven Point

- The sales manager would like to propose a change to pay a salesman on commission basis of \$10 per unit sold rather than on fixed monthly salaries of \$8,000 per month.
- What would be the breakeven points in units for the situations before and after the change?

Effect of Changes in Costs on Breakeven Point

Breakeven point before change:

$$\$600,000/(\$250-\$150)$$

$$= 6,000 \text{ units}$$

Breakeven point after change:

$$(\$600,000 - \$8,000 \times 12)/[\$250-(\$150+\$10)]$$

$$= 5,600 \text{ units}$$

Illustration 1

Effect of Changes in Costs on Breakeven Point

- It does not mean that the proposed scenario is better than the original scenario because of lower breakeven point.
- It all depends on the actual sales volume.
- For example, if the sales volume is 10,000 units, the profit in the original scenario will be \$400,000 ($10,000 \times \$100 - \$600,000$) while that in proposed scenario it will only be \$396,000 ($10,000 \times \$90 - \$504,000$).

Effects of Changes in Costs, Selling Price and Units Sold on the Profit

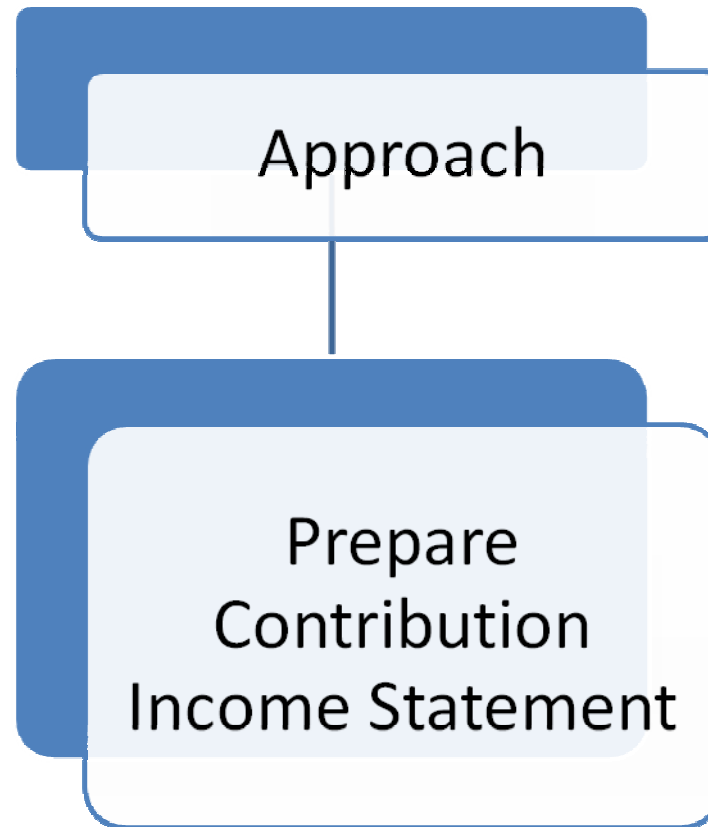


Illustration 2

Effects of Changes in Costs and Units Sold on the Profit

- A company produces and sells a single product. In the current year, 20,000 units will be sold at \$50 each. The fixed cost is \$300,000 and the profit is \$100,000.
- The company is considering spending \$30,000 to launch a promotion campaign in the next year to boost the sales volume by 5%.
- The selling price and other fixed overhead will keep constant over the two years.

Illustration 2

Effects of Changes in Costs and Units Sold on the Profit

Required

- 1) For the current year, calculate:
 - a) the breakeven point in units, and
 - b) the margin of safety in %
- 2) Prepare the income statements for both current year and next year.
- 3) Explain whether the promotion campaign should be launched.

Illustration 2

Effects of Changes in Costs and Units Sold on the Profit

- 1) a) Total contribution = $\$300,000 + \$100,000 = \$400,000$
Contribution per unit = $\$400,000/20,000 = \20
Breakeven point in units = $\$300,000/\$20 = 15,000$ units
- b) Margin of safety in % = $(20,000-15,000)/20,000 \times 100\%$
= 25%

Effects of Changes in Costs and Units Sold on the Profit

2)

Contribution Income	Current Year	Next Year
	\$	\$
Sales (\$50 per unit)	1,000,000	1,050,000
Variable cost (\$30 per unit)	600,000	630,000
Total contribution	400,000	420,000
Less: Fixed cost	300,000	330,000
Net Profit	100,000	90,000

Illustration 2

Effects of Changes in Costs and Units Sold on the Profit

- 3) The promotion should not be launched as it would lower the net profit.

Activity 1

Illustrative Integrated Question

Cost-Profit-Volume Analysis

Question (1)

- A manufacturing company produces and sells a single product. The accountant has just prepared the company's budget for the coming year. The budgeted data is extracted as follows:

Sales volume	90,000 units
Fixed costs	\$440,000
Variable costs per unit	\$10
Loss	\$80,000

Question (2)

- The directors are dissatisfied with the budgeted loss and suggest proposals for improvement.
- Director A suggests spending \$50,000 on advertising to increase sales. He wishes to achieve a target profit of \$100,000.
- Director B suggests reducing selling price by \$1 per unit to increase sales. He expects that the sales volume would increase by 80%.
- Director C suggests buying a more efficient machine which would reduce unit variable costs by 50%. The useful life of the machine is 1 year.

Question (3)

Required

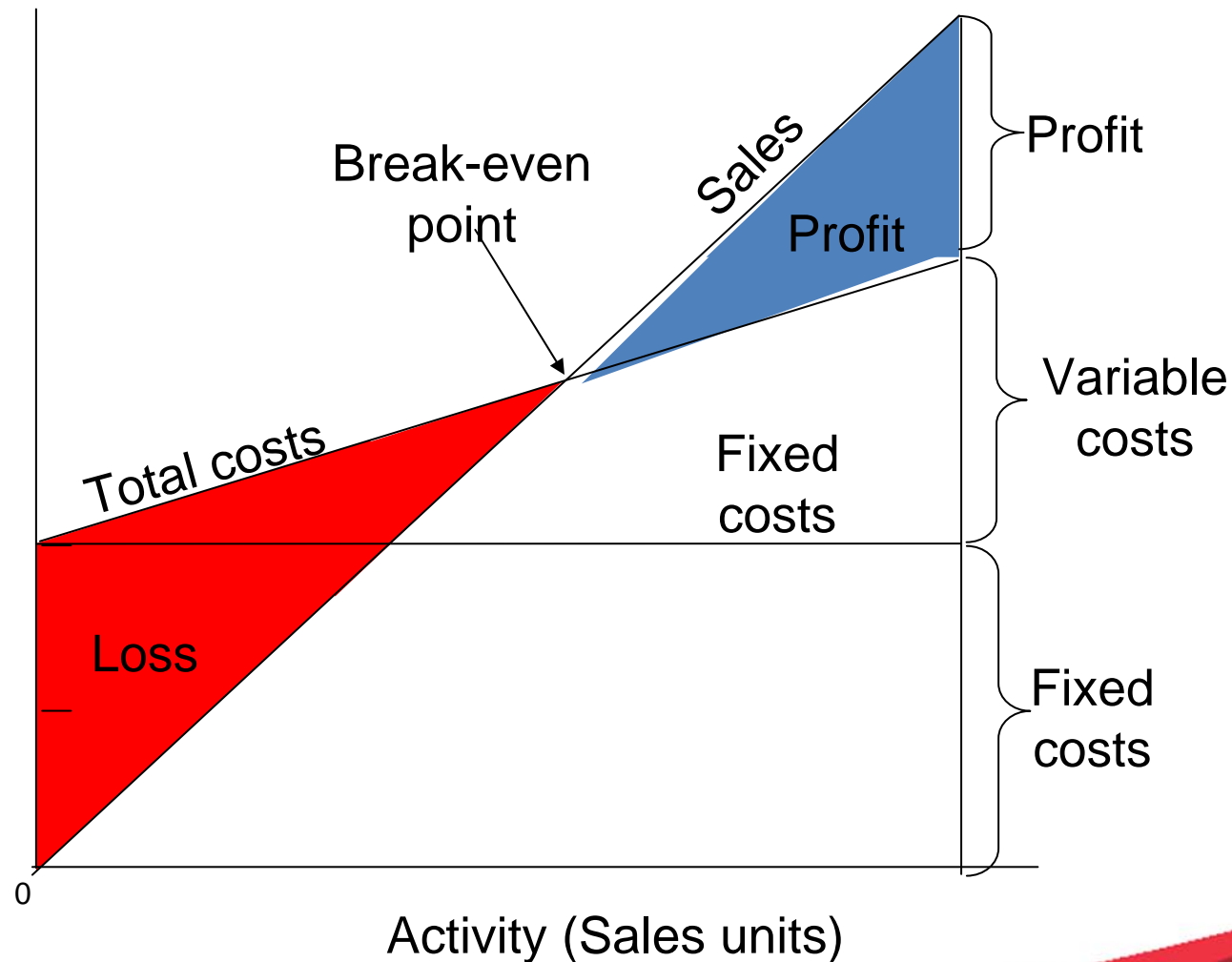
- a) For Director A's proposal, what is the percentage increase in sales required to achieve the target profit?
- b) For Director B's proposal, what would be the profit or loss?
- c) For Director C's proposal, what would be the maximum cost of the machine for breakeven?

Answers

- a) 50%
- b) Profit \$46,000
- c) \$370,000

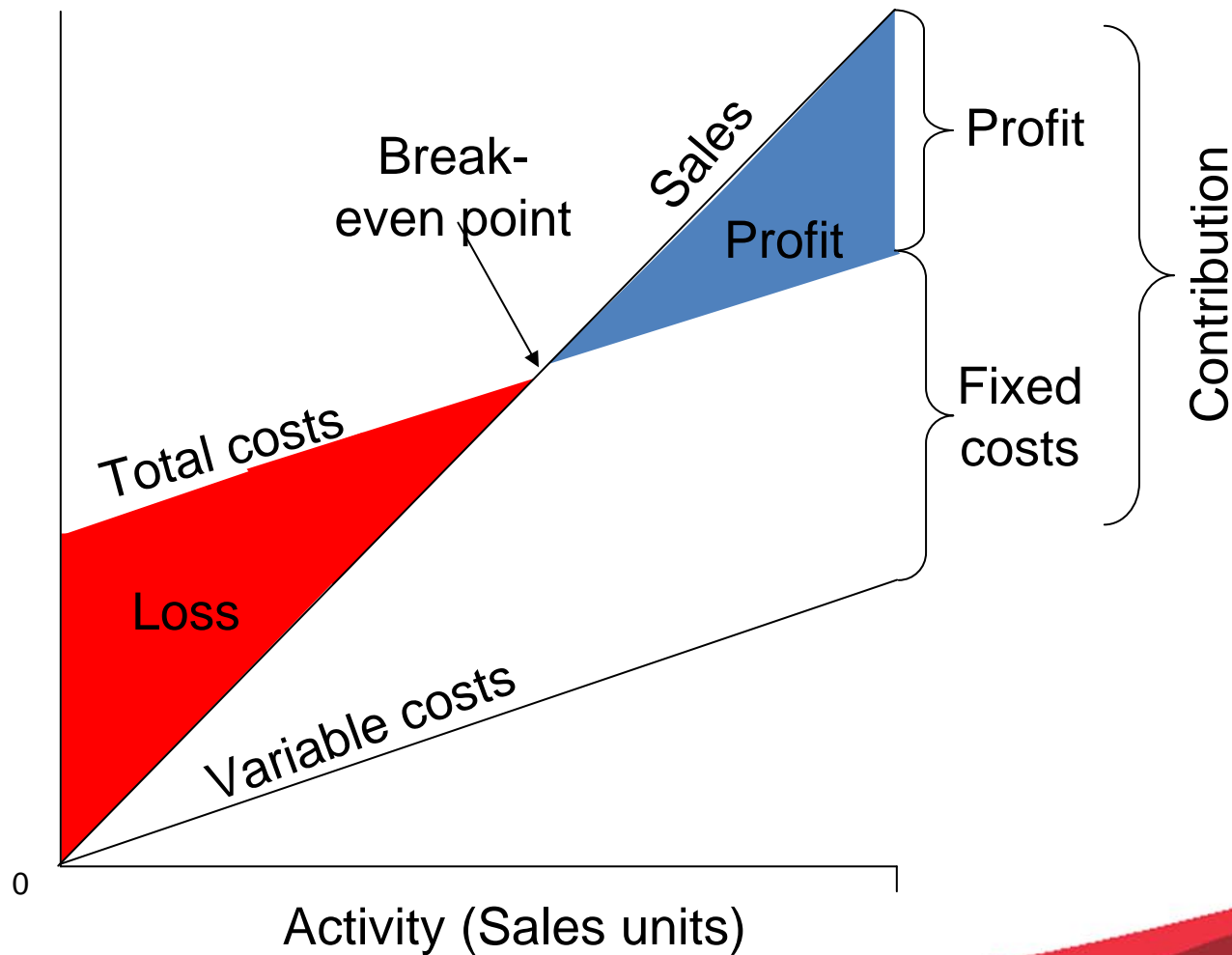
By Graph – Breakeven Chart

Sales revenue/Costs



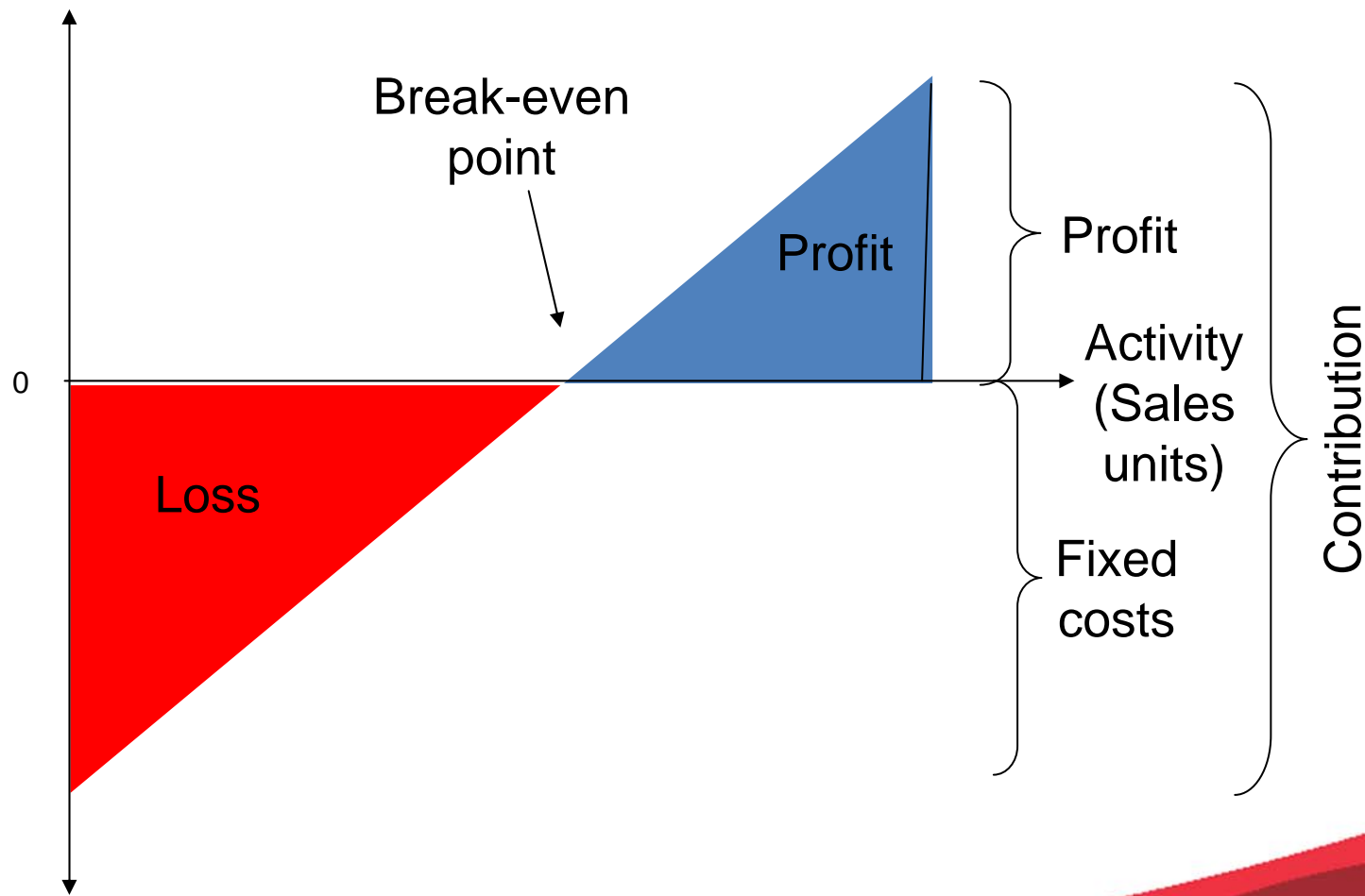
By Group – Contribution Graph

Sales revenue/Costs



By Graph – Profit-Volume Graph

Profit / Loss (\$'000)



Breakeven Point for Sales Mix

When a company produces multiple products, it is assumed that the relative combination of the products sold (sales units) will be constant.

Illustration 3

Breakeven Point for Sales Mix

- Product X and Product Y are sold in sales mix of 3:1. Details about the two products are:

	Product X	Product Y
Selling price per unit	\$5	\$10
Variable cost per unit	\$4	\$3
Unit contribution	\$1	\$7

- The fixed cost is \$30,000.
- What is the breakeven point in units and dollars?

Illustration 3

Breakeven Point for Sales Mix

$$\begin{aligned} & \text{Breakeven Point (in standard batches)} \\ &= \frac{\text{Fixed Cost}}{\text{Contribution of 1 standard batch}} \\ &= \frac{\$30,000}{\$1 \times 3 + \$7 \times 1} = 3,000 \text{ batches} \end{aligned}$$

Since 1 standard batch consists of 3 units of product X and 1 unit of product Y, the breakeven point is 9,000 units of product X and 3,000 units of product Y.

Illustration 3 Breakeven Point for Sales Mix

Breakeven point (in \$)

Sales	\$
Product X: 9,000 x \$5	45,000
Product Y: 3,000 x \$10	30,000
Breakeven point	75,000

Illustration 3

Breakeven Point for Sales Mix

Alternatively, the breakeven point in \$ can be calculated by using the contribution margin ratio:

Contribution in standard sales mix

$$= \$1 \times 3 + \$7 \times 1 = \$10$$

Selling price in standard sales mix

$$= \$5 \times 3 = \$10 \times 1 = \$25$$

Illustration 3 Breakeven Point for Sales Mix

- Hence, the contribution margin ratio is

$$\frac{\$10}{\$25} = 0.4$$

- The breakeven point in \$ is

$$\frac{\$30,000}{0.4} = \$75,000$$

Illustration 4

Effect of Change in Expenses on Sales Mix

- Continue with illustration 3. As the marketing manager observes that Product Y is more profitable, he is considering spending additional \$5,000 on marketing campaign to boost the sales of Product Y. It is estimated that sales volume of Product Y can be increased by $\frac{1}{3}$.
- How many units of Product X should be sold at least in order to achieve breakeven?

Illustration 4

Effect of Change in Expenses on Sales Mix

	\$
Original fixed cost	30,000
Marketing expenses	5,000
Contribution from Product Y (\$7 x 3,000 x 4/3)	(28,000)
Uncovered fixed cost	7,000

Hence, number of units of Product X to be sold for achieving breakeven =

$$\frac{\$7,000}{\text{Unit Contribution of Product X}} = \frac{\$7,000}{\$1} = 7,000 \text{ units}$$

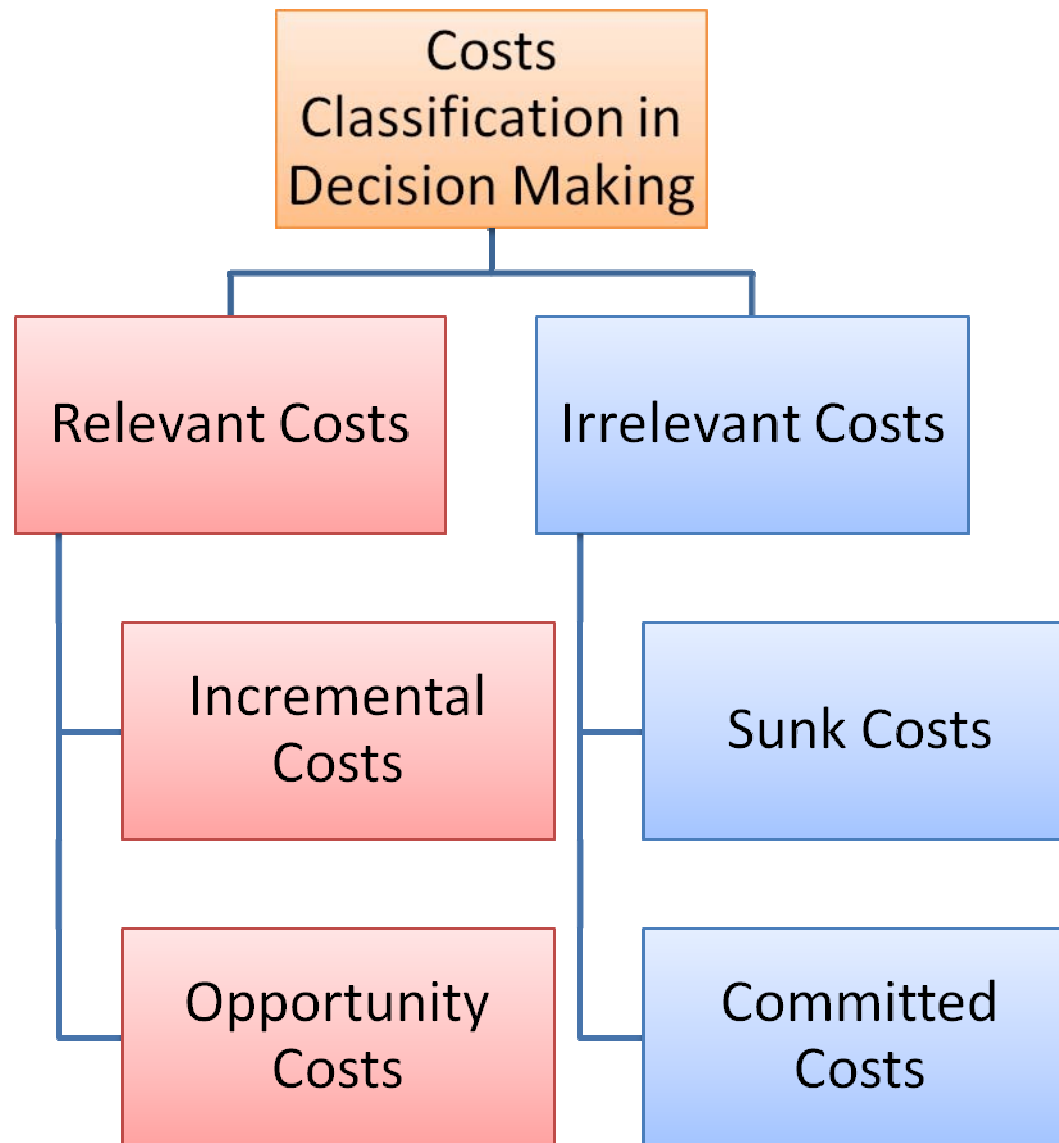
Assumptions of C-V-P Analysis

- Selling price per unit and variable cost per unit are constant.
- Fixed cost per period is constant.
- Production units equal sales units.
- A single product is sold or the sales mix is constant.

Limitations of C-V-P Analysis

- Unit selling price may vary, e.g. due to bulk discounts offered to customers.
- Unit variable costs per unit may vary, e.g. due to economies of scales or overtime premium etc.
- Fixed costs may change at different levels of activity, e.g. step costs, i.e. in different relevant ranges, the fixed cost will vary.

Cost Classification & Items



Relevant Cost vs. Irrelevant Cost

Relevant Cost

Cost that will be
changed by a
decision

Irrelevant Cost

Cost that will not be
changed by a
decision

Relevant Costs

Incremental Cost

Additional cost which will be specifically incurred because of a decision

Opportunity Cost

Benefit which will be forgone when the choice of one course of action requires an alternative course of action be given up

Irrelevant Cost

Sunk Cost

Cost of a resource already acquired and are unaffected by choice between alternatives

Committed Cost

Cost which has been committed although it has not been incurred or paid.

Material Cost: How Relevant?

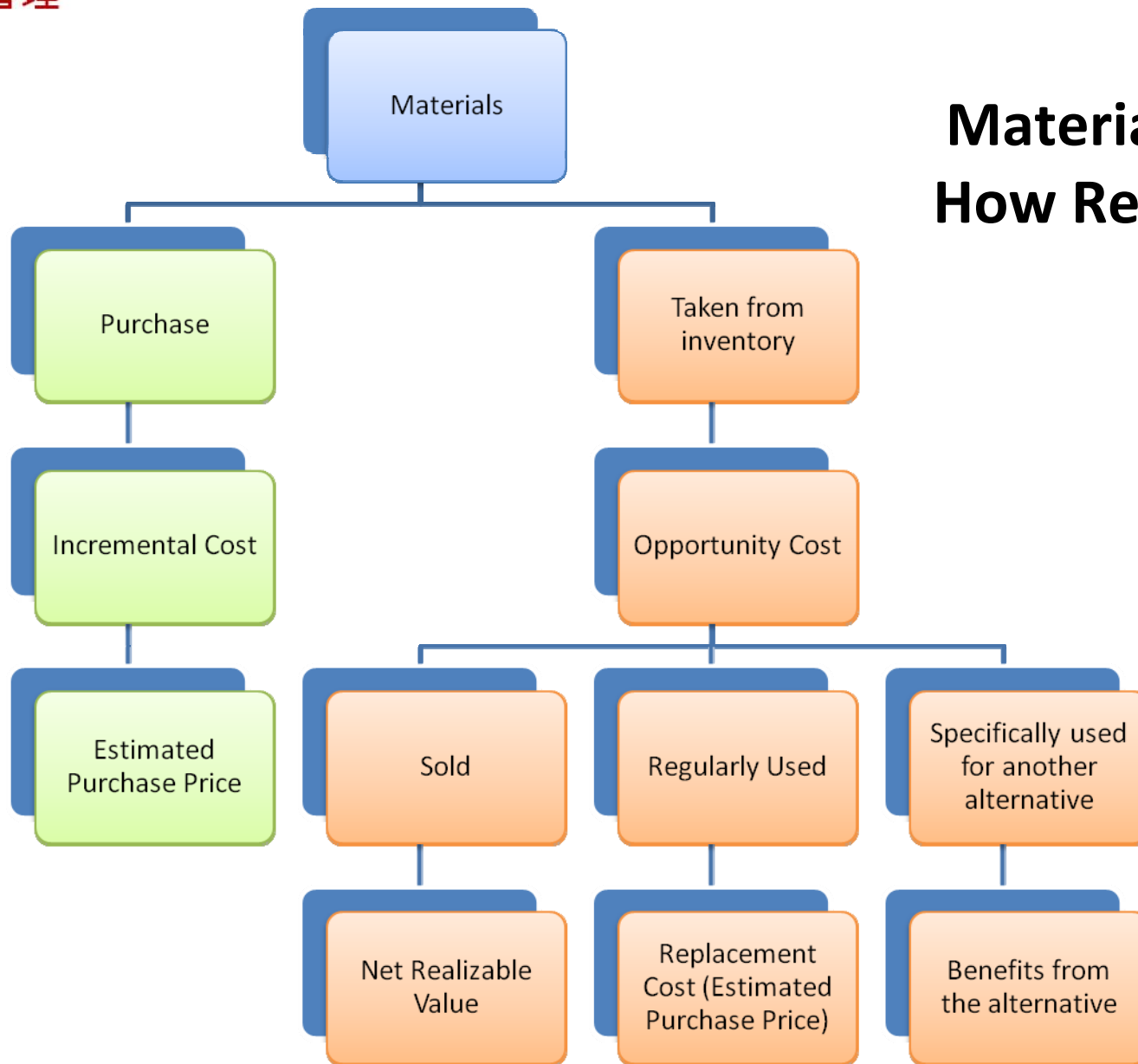


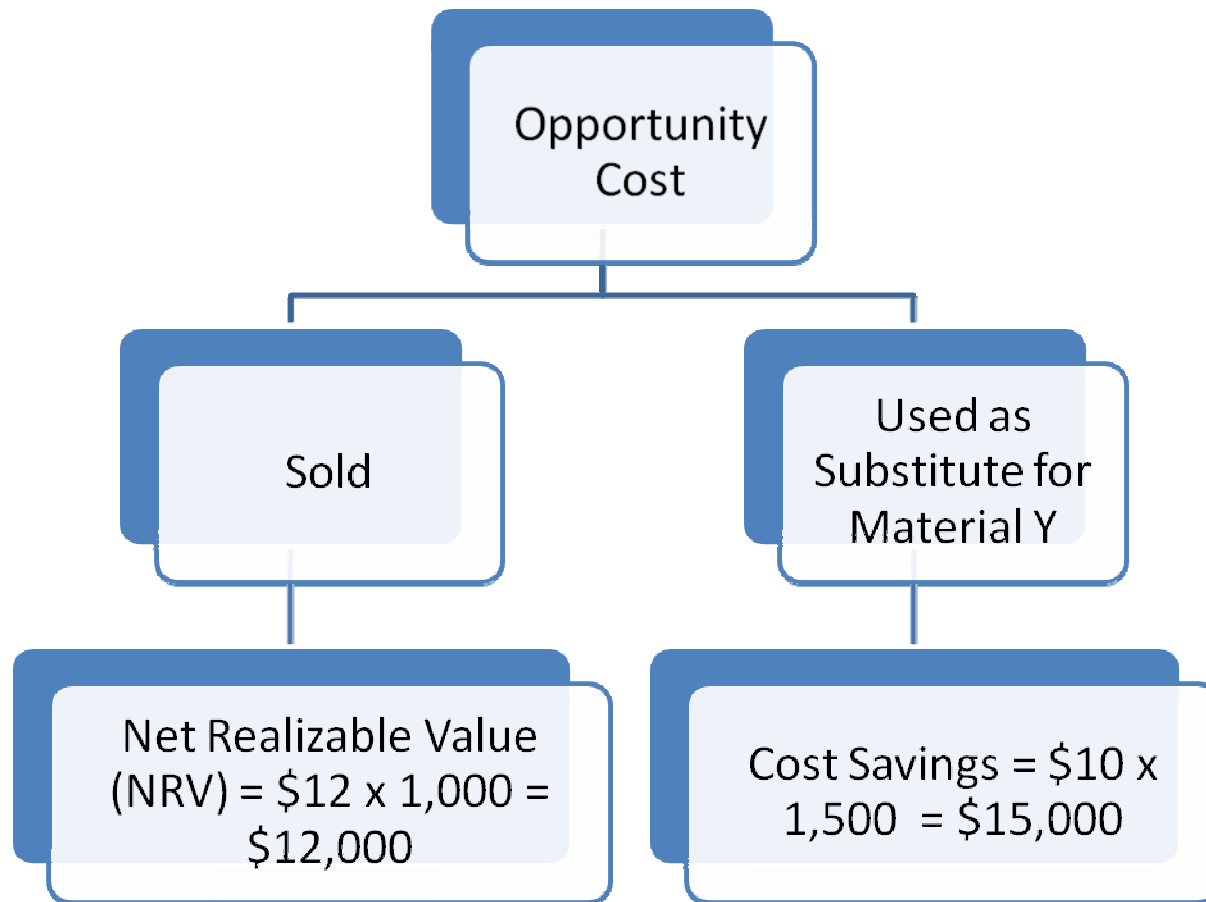
Illustration 5

Material Cost: How Relevant?

- A job requires 1,000 units of material X which have already been in the inventory.
- They were purchased at a cost of \$8 per unit.
- The materials can be sold at a net realizable value of \$12 per unit.
- It can also be used in another job as substitute for 1,500 units of material Y of which the current purchasing price is \$10.

Illustration 5

Relevant Cost for Material X



Analysis:

- The original purchase price of material X is irrelevant since it is a sunk cost
- The opportunity cost would be the higher of NRV or Costing Savings, i.e. \$15,000
- Therefore, the relevant cost of material X is \$15,000

Labour Cost: How Relevant?

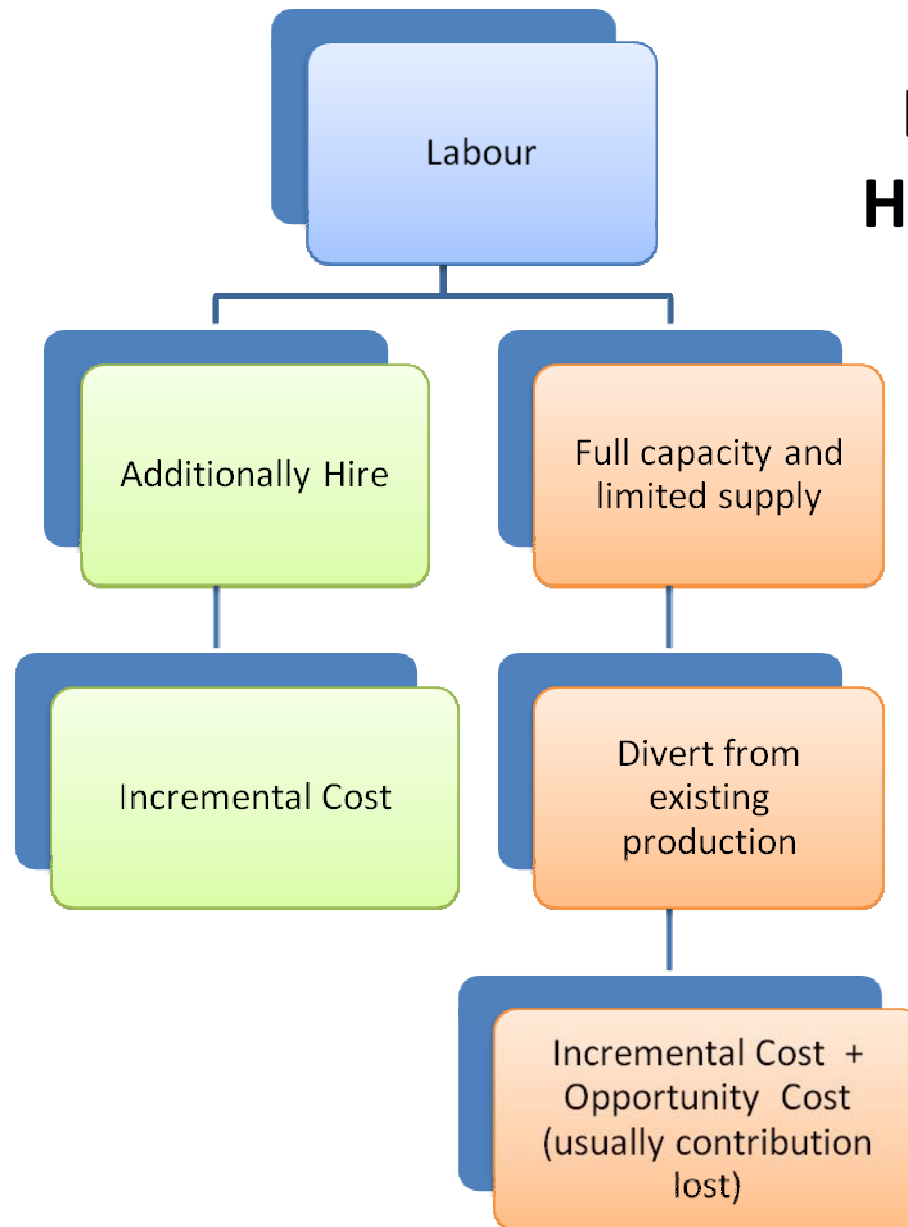


Illustration 6

Labour Cost: How Relevant?

A company has been offered a special order which requires 1,000 direct skilled labour hours at \$400 per hour. Because of full capacity and limited supply, the direct skilled labour hours have to be diverted from existing production of 500 units of Product X which gives contribution of \$300 per unit.

Illustration 6

Labour Cost: How Relevant?

Relevant Costs for Direct Labour	\$
Incremental Cost ($\$400 \times 1,000$)	400,000
Contribution Lost ($\$300 \times 500$)	150,000
	550,000

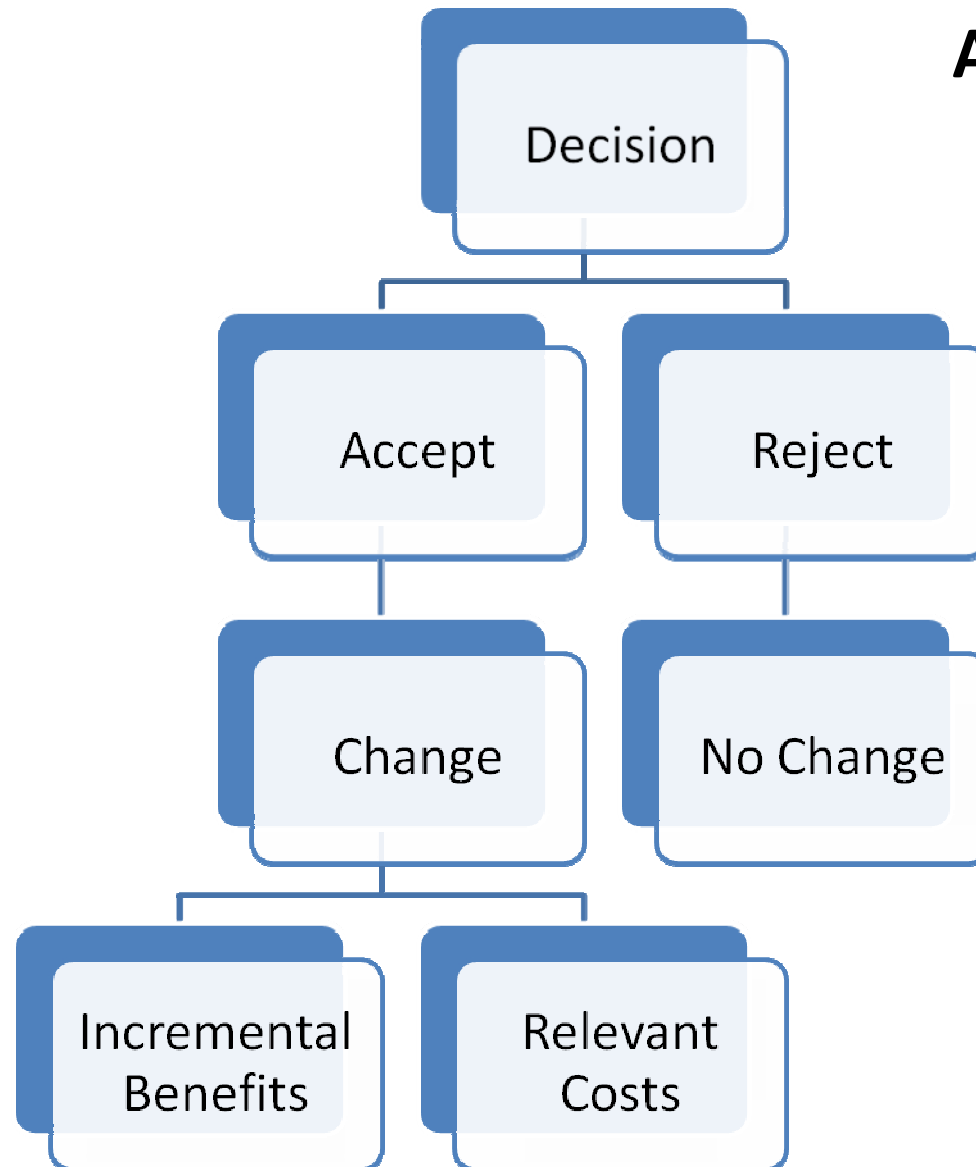
Short-Term Business Decisions

Factors to Consider in Business Decision Making

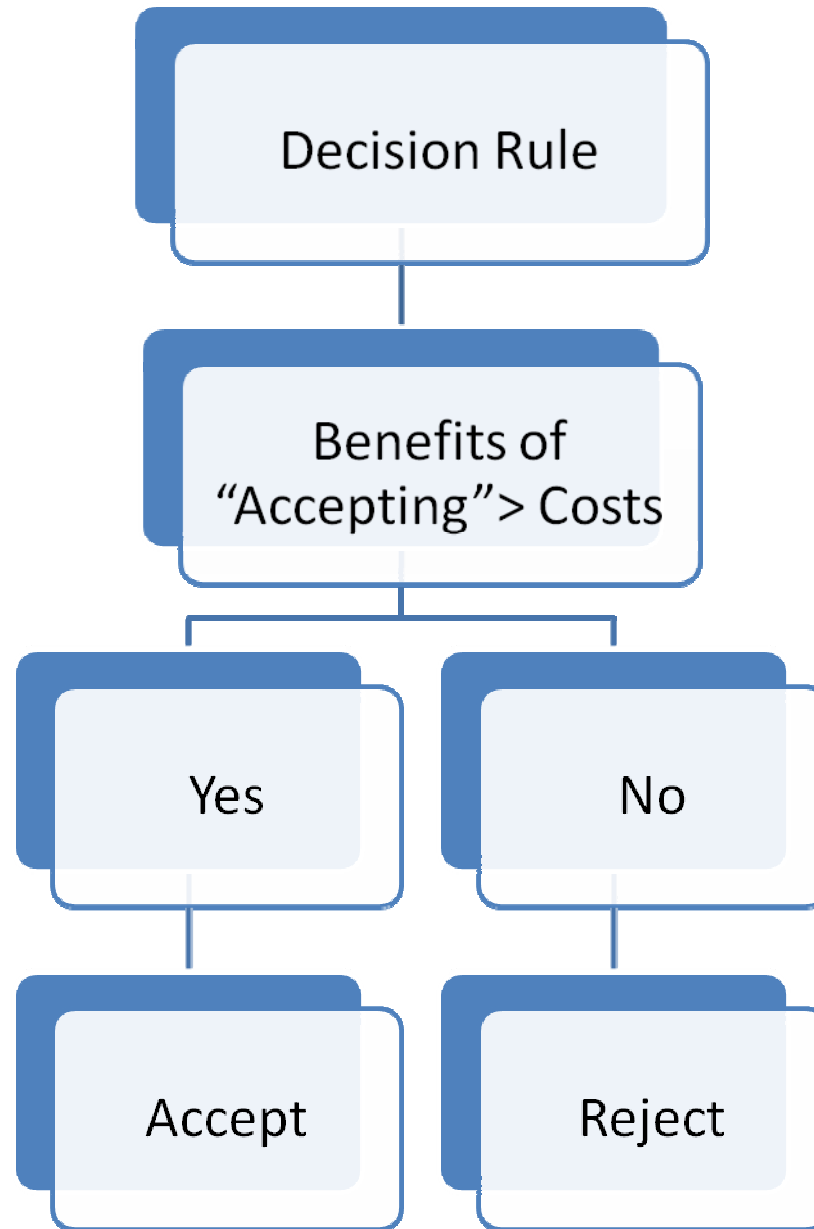
- Quantitative factors: cost vs. benefit analysis in monetary terms.
- Qualitative factors: social responsibility, corporate goodwill, employee morale etc.

Concentrate this in this course

Accept or Reject an Order at a Special Price



Accept or Reject an Order at a Special Price



**Accept or Reject
an Order at a
Special Price**

Approach

Prepare a cost-benefit
analysis for
“accepting”

Accept or Reject an Order at a Special Price

A firm currently makes 50,000 units of product per annum and sells at \$30 each. The operating statement is as follows:

	\$
Sales (50,000 x \$30)	1,500,000
Less: Materials	(500,000)
Labour	(680,000)
Contribution	320,000
Less: Fixed Costs	(200,000)
Net Profit	120,000

Accept or Reject an Order at a Special Price

A customer offers an order for 10,000 units at selling price of \$28 each.

If the order is accepted:

- Fixed cost would increase to \$250,000.
- Extra labour would be required at overtime premium of 20%.
- 4% discount would be obtained for all materials.

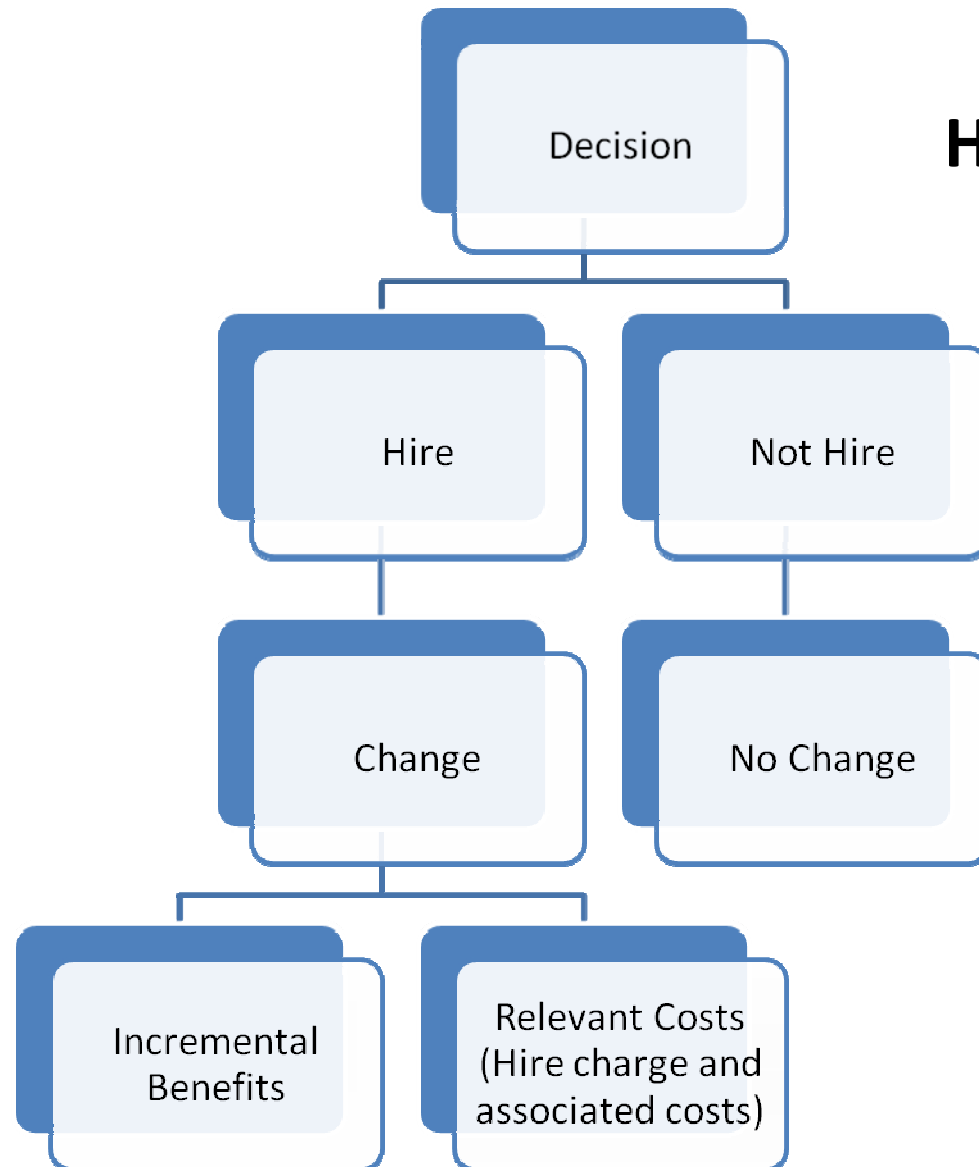
Accept or Reject an Order at a Special Price

Cost-Benefit Analysis for Accepting	\$
<u>Incremental Benefits</u>	
Increase in sales revenue (10,000 x \$28)	280,000
Savings in material cost for existing production (500,000 x 4%)	20,000
	300,000
<u>Incremental Costs</u>	
Material cost for additional production ($\$500,000/50,000 \times 10,000 \times 96\%$)	96,000
Labour cost for additional production ($\$680,000/50,000 \times 10,000 \times 120\%$)	163,200
Increase in fixed cost ($\$250,000 - \$200,000$)	50,000
	309,200
Decrease in net profit	9,200

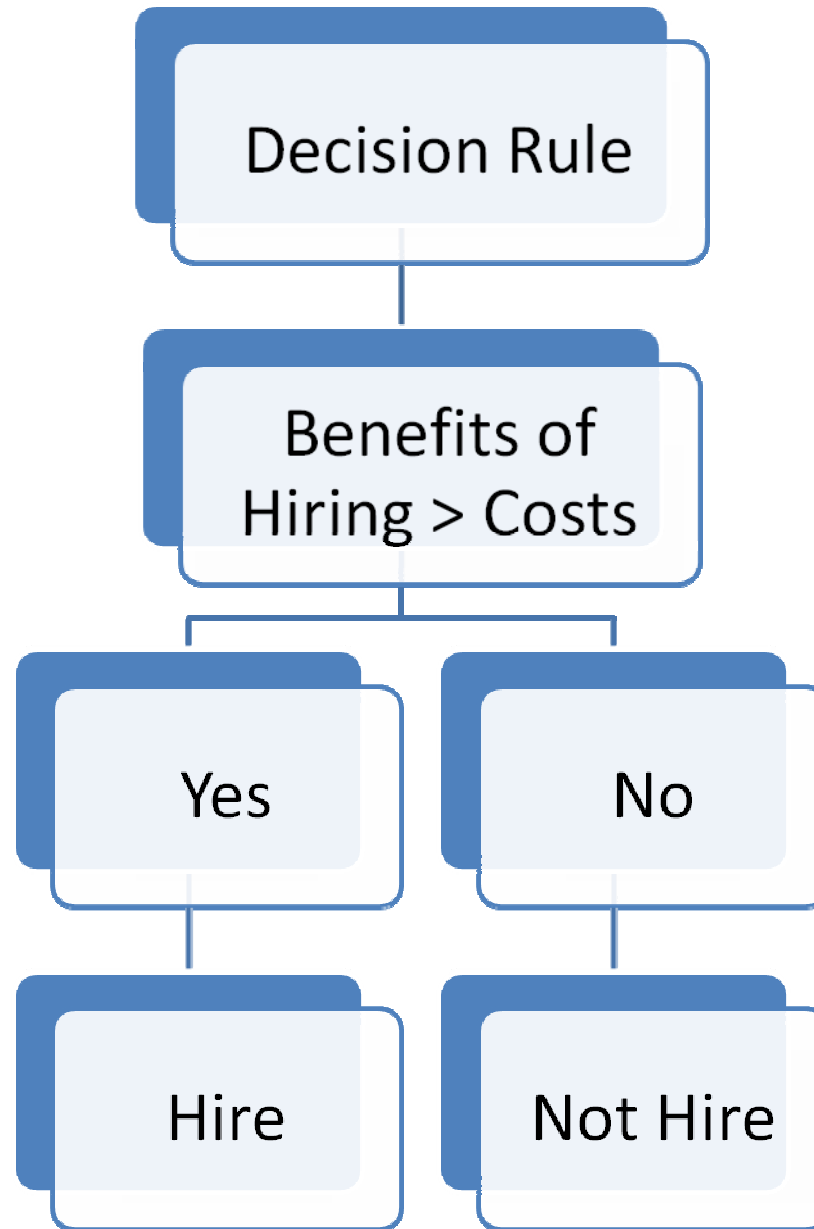
Accept or Reject an Order at a Special Price

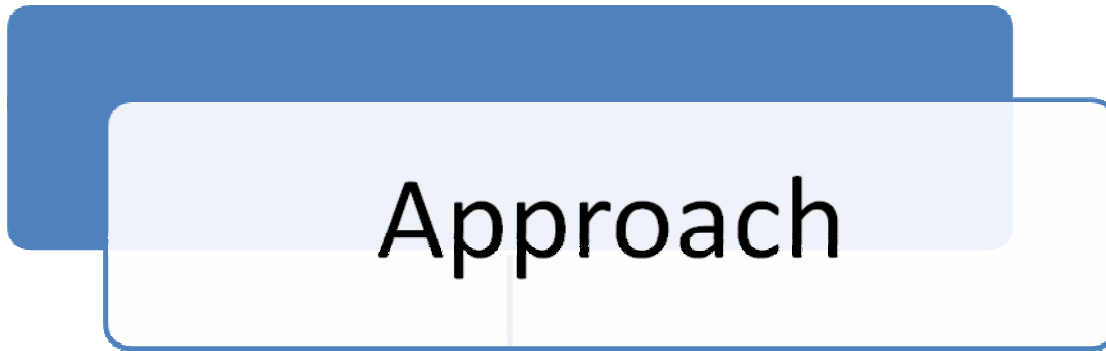
- Conclusion: As the incremental benefit is less than the increment cost, the order should be rejected.

Hire or Not Hire



Hire or Not Hire





Hire or Not Hire

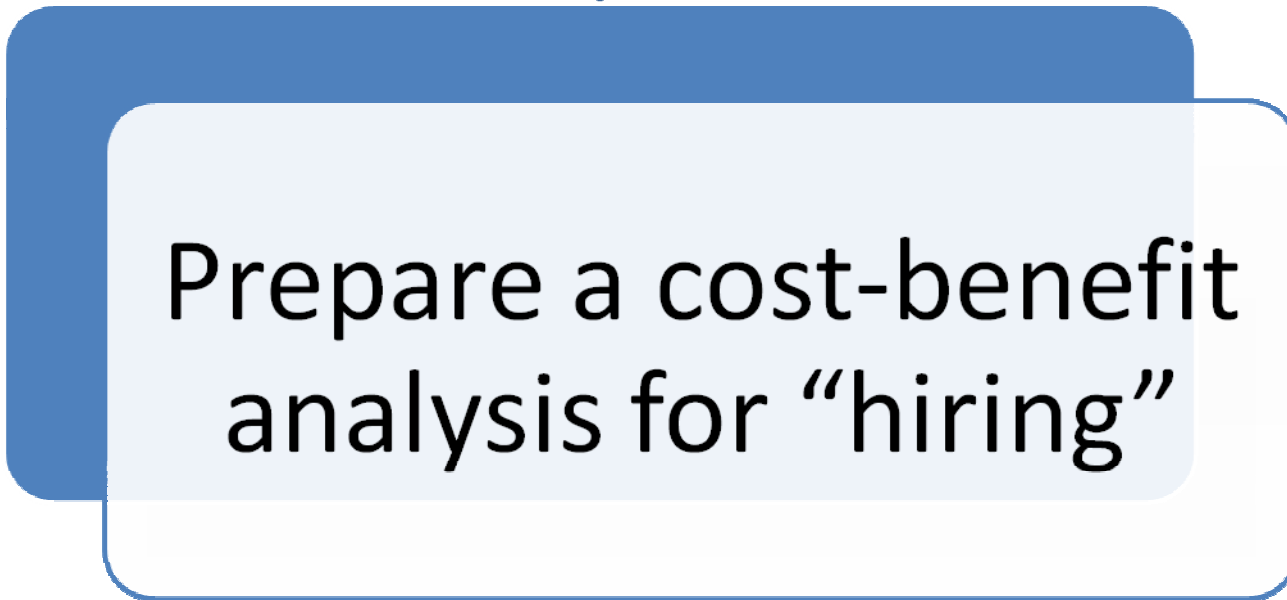


Illustration 8

Hire or Not Hire

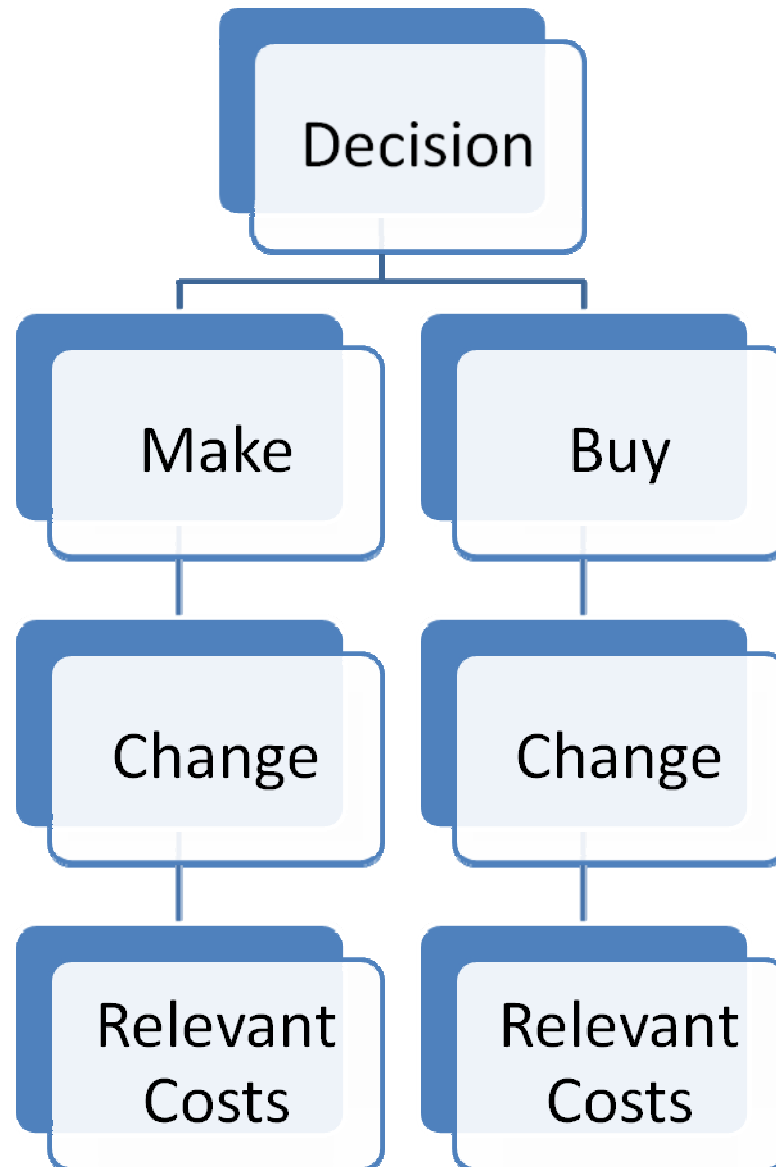
- A company currently produced 1,000 units of product X per month at unit variable costs of \$50.
- Product X was sold at \$120 per unit.
- The company is considering hiring an additional machine which can reduce the unit variable costs to \$48 and increase production by 20%.
- The monthly hire charge is \$200,000.

Illustration 8 Hire or Not Hire

Cost-Benefit Analysis for Hiring	\$
Savings in variable costs for existing production [($\$50 - \48) x 1,000]	2,000
Increase in contribution from additional production [($\$120 - \48) x (1,000 x 20%)]	14,400
Increase in contribution	16,400
Less: Hire charge	20,000
Decrease in profit	3,600

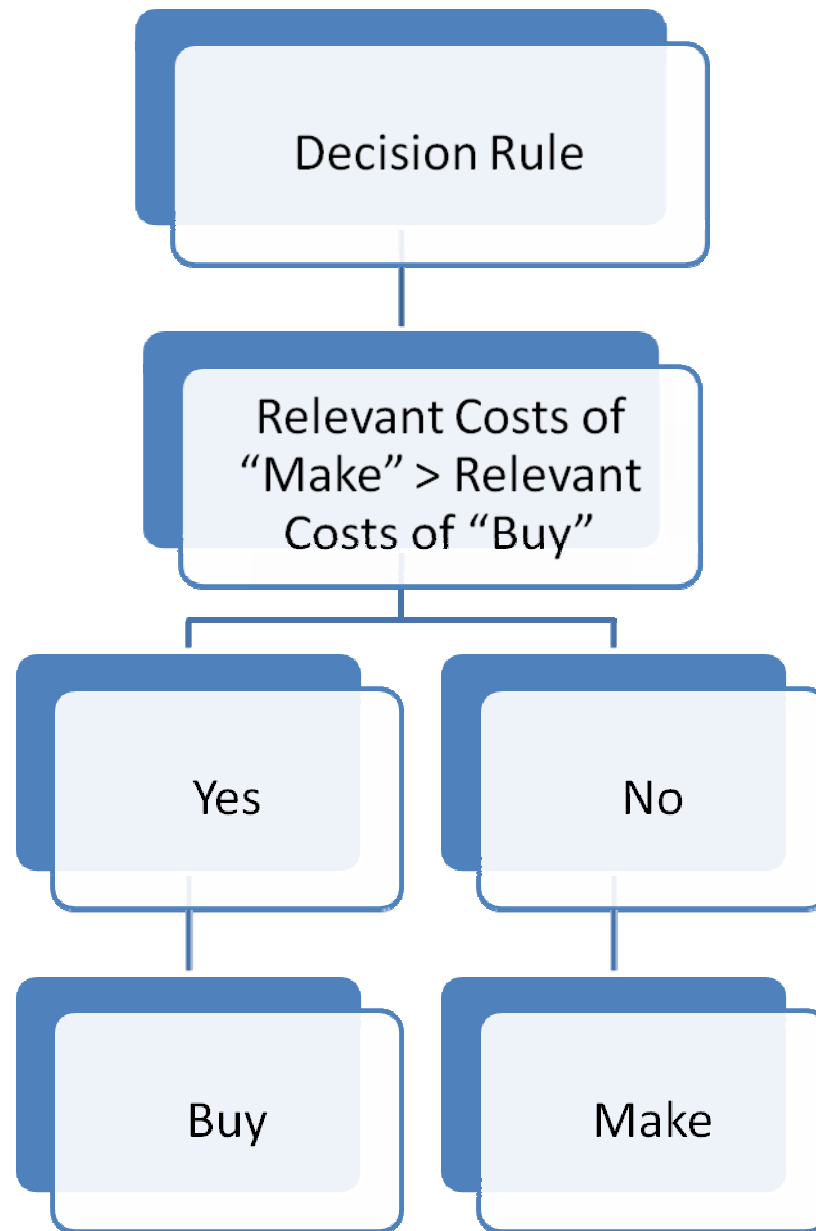
Illustration 8 Hire or Not Hire

- Conclusion: Since hiring would lead to a decrease in profit, it should not be hired.



Make or Buy

Make or Buy



Make or Buy

Approach

Prepare relevant cost statements for both alternatives

Illustration 9

Make or Buy

- A company requires 800 units of component X specifically for a single order and is considering making the components itself or buying them from outside supplier.
- In making, it requires \$3,000 materials, 100 labour hours at hourly rate of \$28 to be diverted from other teams which are idle but cannot be fired because of the employment contract.
- If the company makes the components itself, the existing production of product Y will fall by 100 units. Product Y provides a contribution of \$8 per unit.
- The components are sold at a multiple of 1,000 units at \$4,500 per 1,000 units. Any excess of the demand can be re-sold at a price of \$1 per unit.

Illustration 9 Make or Buy

Relevant Cost for Making	\$
Materials	3,000
Contribution lost ($\$8 \times 100$)	800
Total Relevant Cost	3,800

Since the labour is idle, the cost is irrelevant.

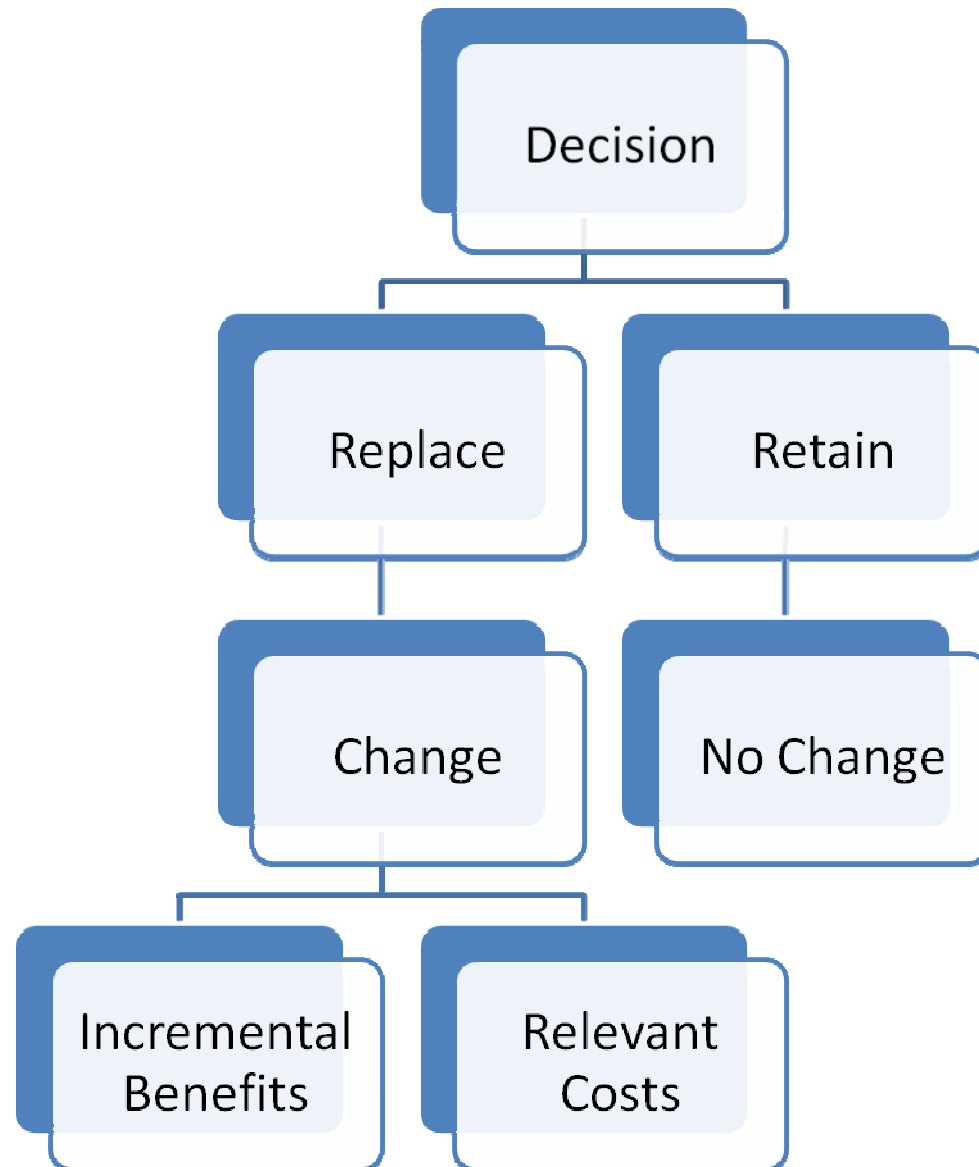
Illustration 9 Make or Buy

Relevant Cost for Buying	\$
Purchase cost	4,500
Re-sale of excess [$(1,000-800) \times \$1$]	(200)
Total Net Relevant Cost	4,300

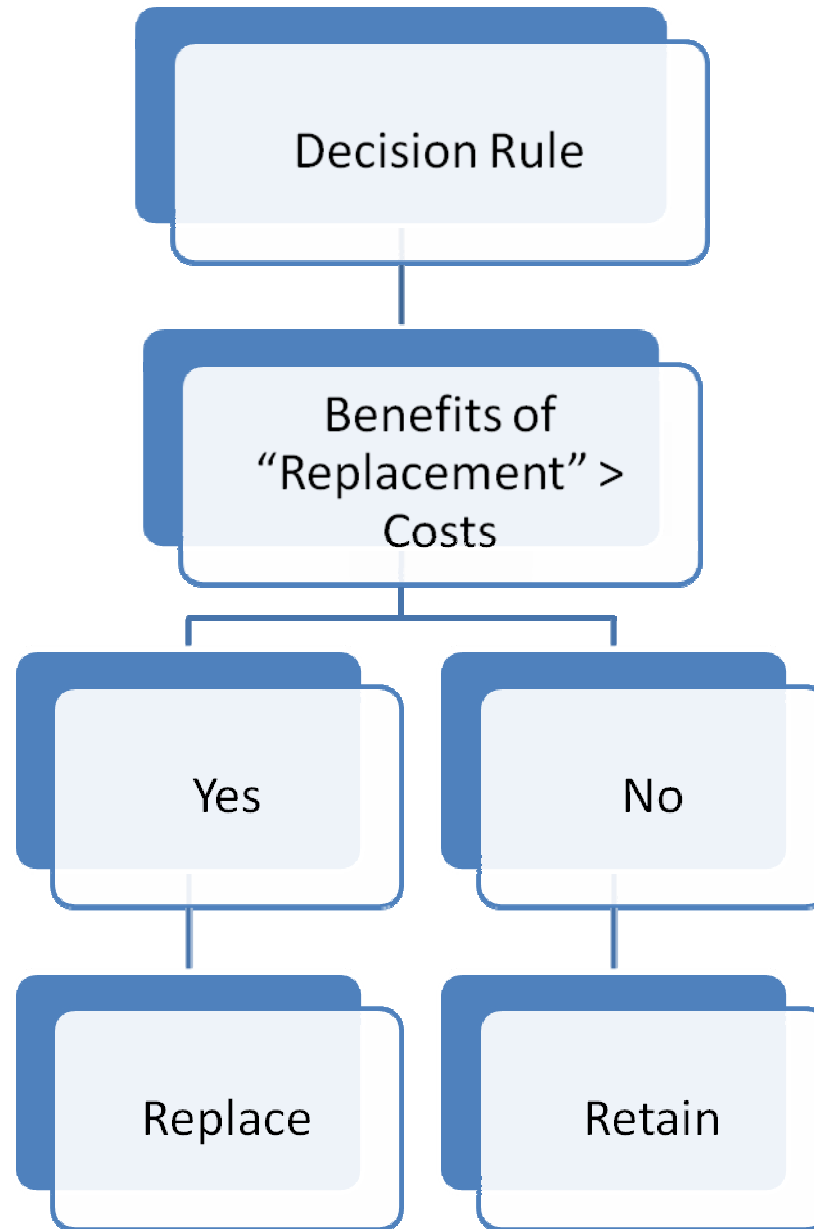
Illustration 9 Make or Buy

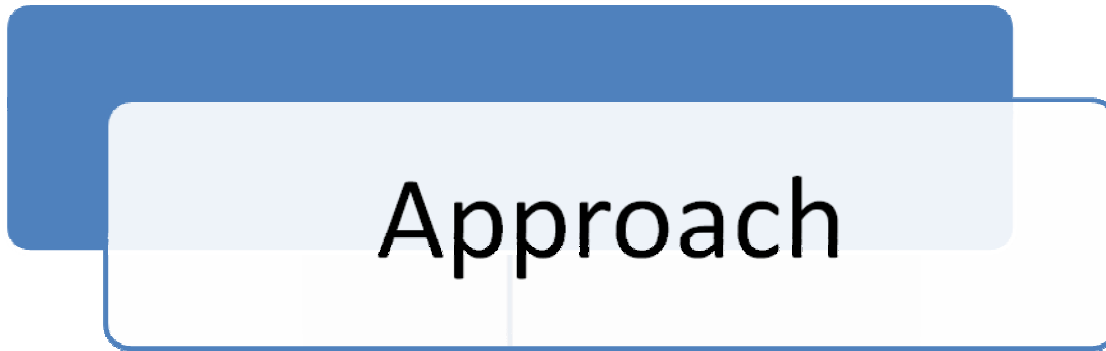
- Conclusion: Since the relevant cost for making is lower than that of buying, the components should be made.

Retain or Replace Equipment



Retain or Replace Equipment





**Retain or
Replace
Equipment**

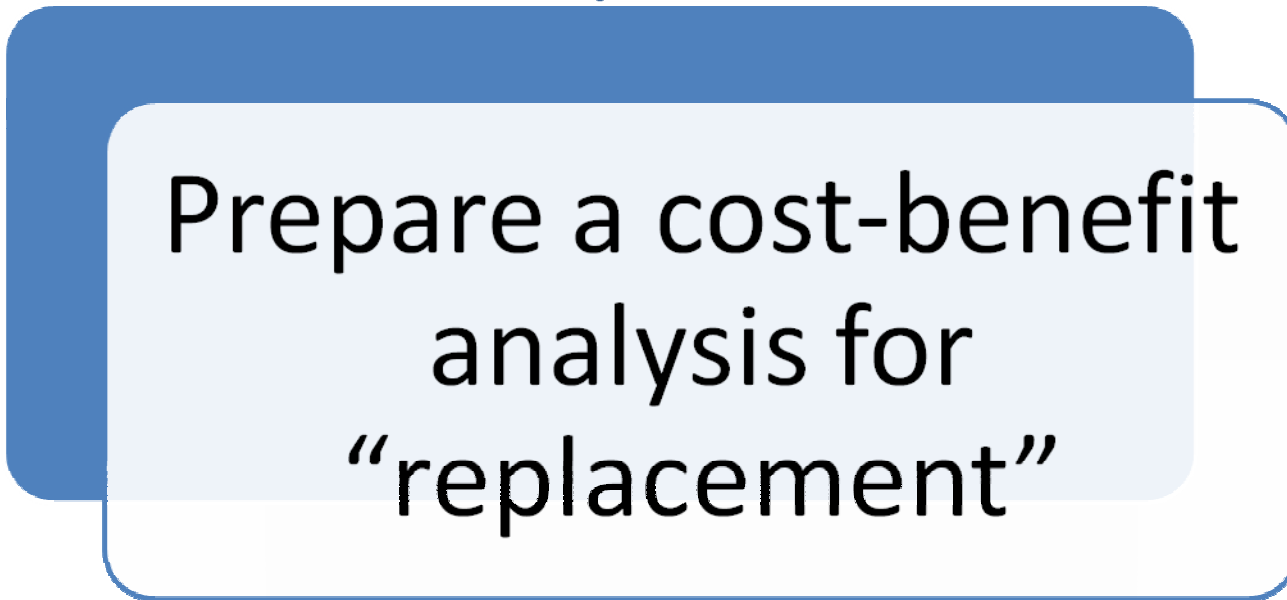


Illustration 10

Retain or Replace Equipment

A company is considering replacing an old machine with a new one. Details about the old machine and the new machine are as follows:

<u>Old Machine</u>	
Original Cost	\$1,000,000
Depreciated amount	\$800,000
Remaining useful life	3 years
Current disposal value	\$10,000
Disposal value after 3 years	Nil

Illustration 10

Retain or Replace Equipment

<u>New Machine</u>	
Current purchase cost	\$300,000
Useful life	3 years
Disposal value after 3 years	\$60,000

The new machine can reduce operating costs by \$80,000 per annum.

Illustration 10

Retain or Replace Equipment

Cost-Benefit Analysis for Replacement	\$
<u>Incremental Benefits of Replacement</u>	
Total costs saving (3 x \$80,000)	240,000
Disposal value of new machine after 3 years	60,000
Current disposal value of old machine	10,000
	<hr/>
	310,000
Less: <u>Incremental Costs</u>	
Purchase cost of new machine	(300,000)
	<hr/>
Net Incremental Benefits of Replacement	10,000

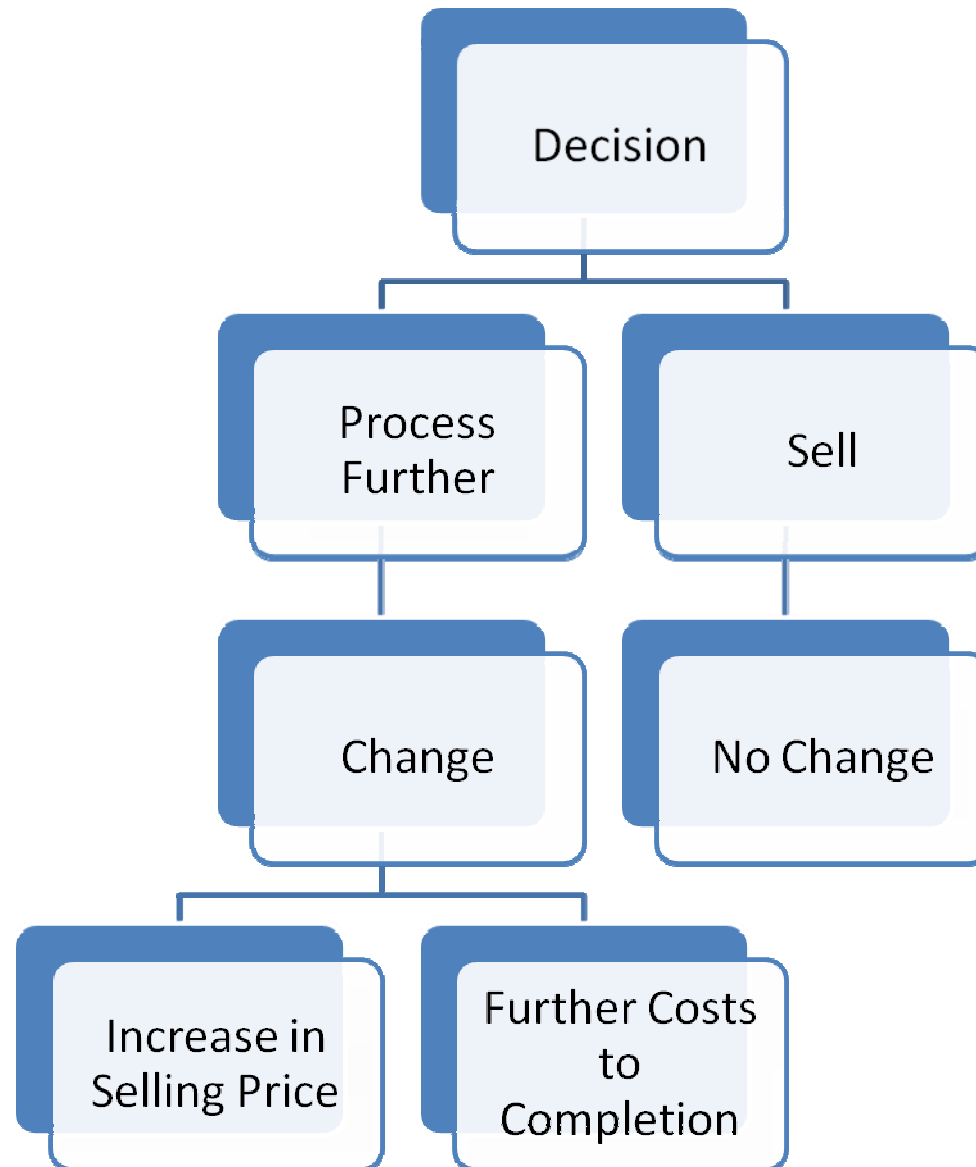
Note: Time value of money is ignored.

Illustration 10

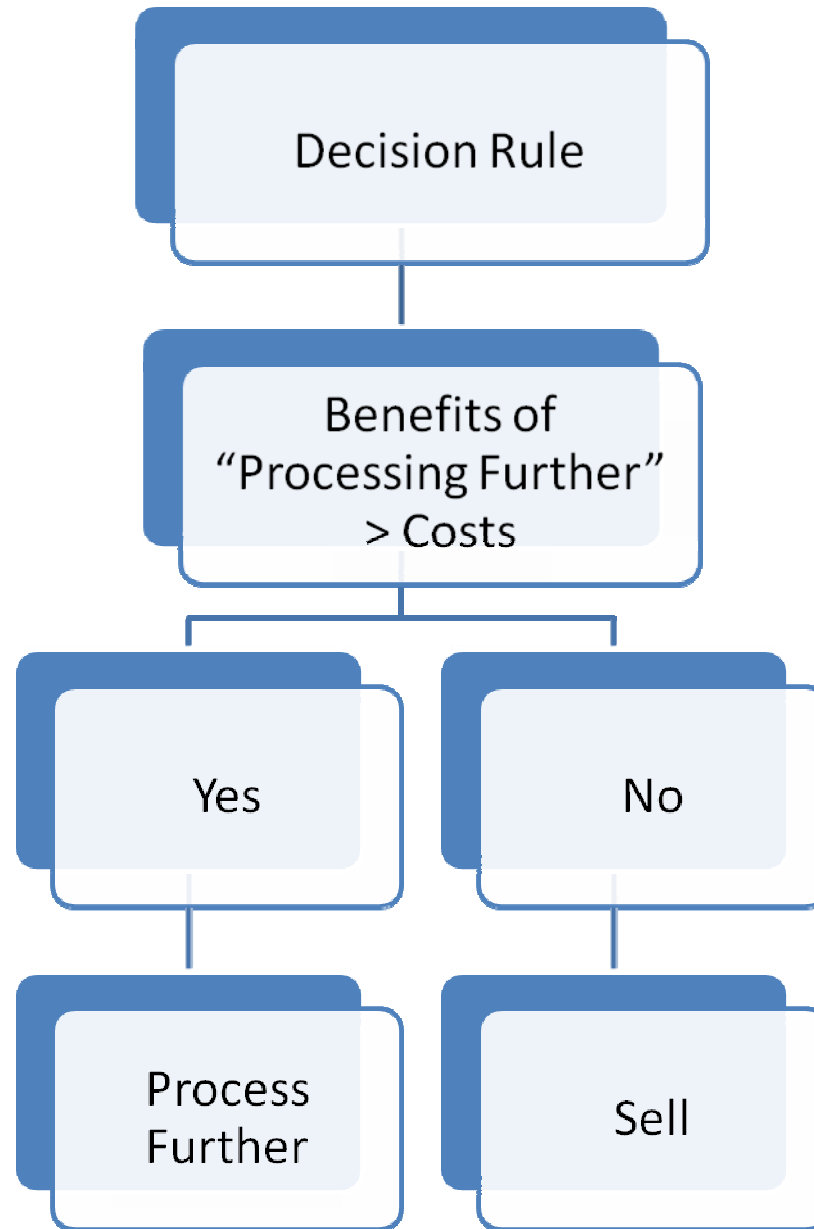
Retain or Replace Equipment

- Conclusion: Since replacement would make a net incremental benefit, it should be replaced.

Sell or Process Further



Sell or Process Further



Approach

Sell or Process
Further

Prepare a cost-benefit
analysis for “Further
Processing”

Illustration 11

Sell or Process Further

- A company is considering whether to process a semi-finished product which has been produced at total variable cost of \$60,000 and can be sold at \$100,000.
- If the semi-finished product is further processed to make it a finished product, it can be sold at \$220,000. The costs involved in the process are as follows:

	\$
Direct materials	150,000
Direct labour	10,000
Overheads	180,000

Illustration 11

Sell or Process Further

- Contract has been signed for the purchase of the \$150,000 materials. The materials are for special purpose and cannot be used in another alternative. If it is not used, it can be sold at \$30,000.
- Overheads include \$70,000 specific to further process and allocated general overheads of \$110,000.
- The finished product after the further process can be sold at \$220,000.

Illustration 11

Sell or Process Further

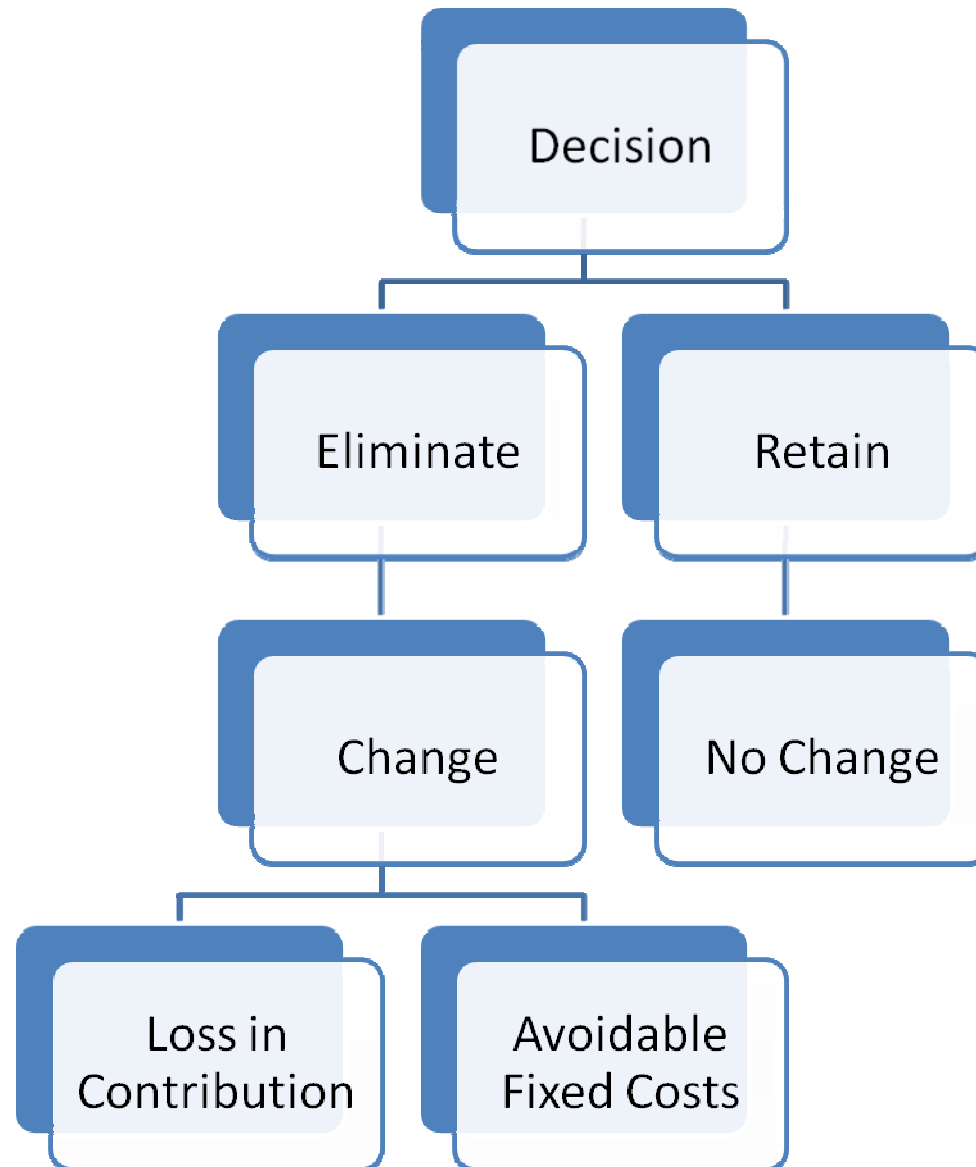
	\$
<u>Incremental Benefits from Further Processing</u>	
Increase in sales revenue (\$220,000 - \$100,000)	120,000
<u>Relevant Costs to Completion</u>	
Direct materials	30,000
Direct labour	10,000
Overheads	70,000
	110,000
Net Incremental Benefits	10,000

Illustration 11

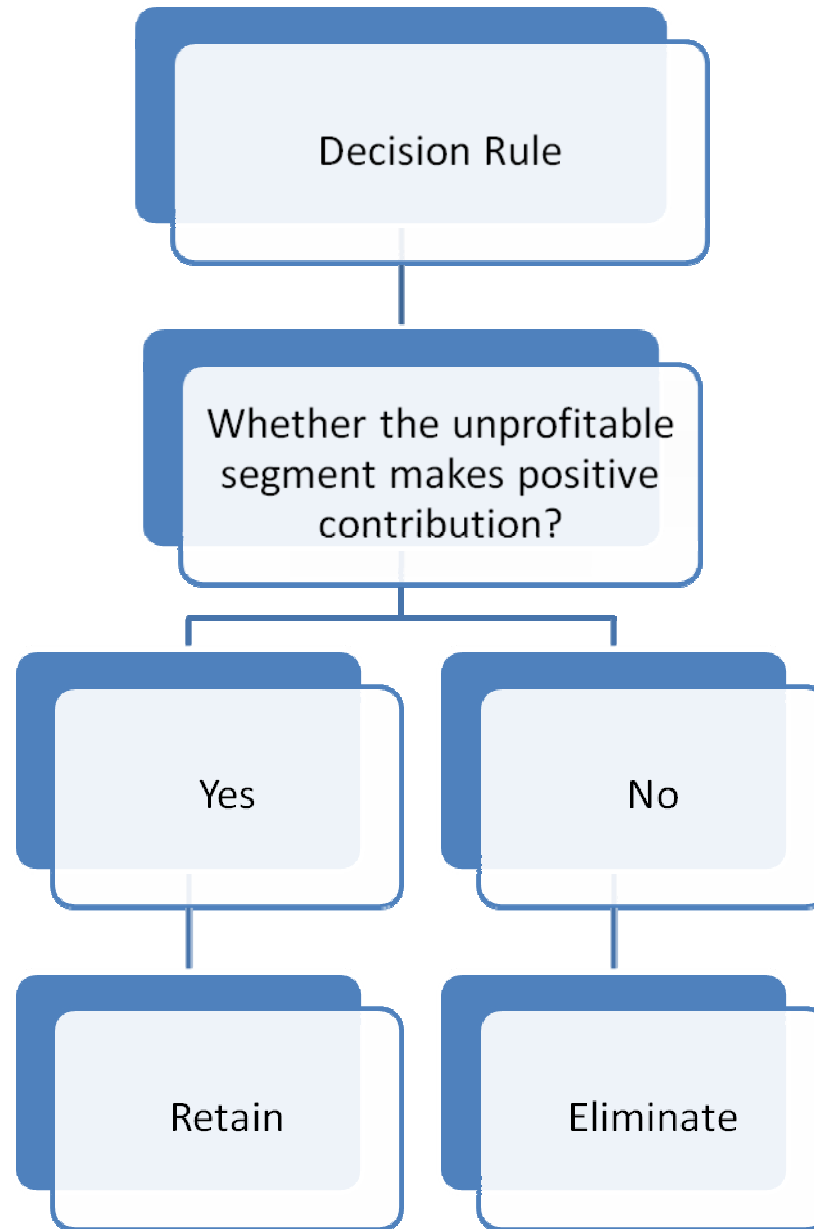
Sell or Process Further

- Conclusion: Since the benefit of further processing is greater than the costs, further processing is recommended.

Eliminate or Retain an Unprofitable Segment



Eliminate or Retain an Unprofitable Segment



**Eliminate or
Retain an
Unprofitable
Segment**

Approach

Prepare contribution income statement by segments including the unprofitable segment

Illustration 12

Eliminate or Retain an Unprofitable Segment

A Company has two departments producing products X and Y respectively. The budgeted operating statement for the coming year is summarized as follows:

	Product X	Product Y
	\$	\$
Sales	60,000	100,000
Less: Total Cost	70,000	80,000
Net Profit / (Loss)	(10,000)	20,000

Of the total cost 70% is variable, 10% is specific fixed and 20% is general fixed.

Illustration 12

Eliminate or Retain an Unprofitable Segment

Contribution Income Statement	Product X	Product Y	Total
	\$	\$	\$
Sales	60,000	100,000	160,000
Less: Variable cost (70% of total cost)	49,000	56,000	105,000
Contribution	11,000	46,000	55,000
Less: Specific fixed cost (10% of total cost)	7,000	8,000	15,000
	4,000	36,000	40,000
Less: General fixed cost (20% of \$150,000)			30,000
Net profit			10,000

Illustration 12

Eliminate or Retain an Unprofitable Segment

- Conclusion: Since the department producing product X makes contribution, it should be retained. If it is eliminated, the profit will be only \$6,000 instead of \$10,000.

Activity 2

Integrated Illustrative Question

Question (1)

A manufacturing company has been asked to quote for a one-off job which would require the following resources:

Material A

1,000 kg would be required. The material is used regularly in other jobs. Currently there are 4,000 kg in the inventory which was purchased at \$8 per kg. It can be sold at \$7 if not used. The current replacement cost is \$9 per kg.

Question (2)

Material B or Material C

100 kg would be required. Material B is not in the inventory and has to be ordered at a current price of \$15 per kg. However, material C can be used to substitute material B. Material C is in inventory and has been purchased at a cost of \$20 per kg. It was specifically purchased for use in a product line which has now been discontinued. It can be sold at a net realizable value of \$8 per kg. If it is used to substitute material B, additional conversion cost of \$6 per kg has to be incurred.

Question (3)

Skilled labour

Direct skilled labour cost for the job would be \$40,000. Skilled labour is in short supply. If the workers work for this job, they cannot work for another job which would make a total contribution of \$5,000.

Question (4)

Unskilled labour

Unskilled labour receiving pay totaling \$16,000 will be transferred from another department which will recruit additional labour at a total cost of \$17,000 including pay and recruitment costs.

Question (5)

Machine hours

50 machine hours would be required. A machine currently lying idle will be used in the job. Details about the machinery are as follows:

Depreciation due to use	\$10,000
Current net realization value	\$240,000
Estimated net realizable value after use	\$200,000

If the machine is not used, the machine hours can be hired from a leasing company which charges \$1,000 per hour.

Question (6)

Required

Calculate the minimum price that should be quoted for the job.

Answer

Relevant Costs	\$
Material A	9,000
Material C	1,400
Skilled labour	45,000
Unskilled labour	17,000
Machine hours	40,000
	112,400

Further Readings

Burgstahler, D., Horngren, C., Schatzberg, J., Stratton, W., & Sundem, G. (2008). ***Introduction to Management Accounting***, 14th ed. Upper Saddle River: Prentice Hall. Chapters 2 & 5-6.

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