CHAPTER EIGHT

Cost Estimation and Analysis of Re-engineering of Manufacturing Process and Reverse Engineering of Products

Chapter Outline

- Cost Analysis
- Marginal Costing
- Standard Costing and Variance Analysis
- Budgeting Control

Cost Analysis

Introduction

- Cost is defined as the value of **economic resources used** in the production of goods, services, income or profit.
- The question to ask is "**which cost**"? That question is welcome in the sense that cost accounting readers must be aware of **cost absorption classification**.
- This topic attempts to conduct **analysis on cost** in respect of various ways of classifying it; its behavioral patterns; and its estimation process.

Cost Classification

- Proper classification of cost is necessary for the clear understanding of the cost.
- The cost can be classified according to their **common characteristics**.
- The classification may be:
  1. **Behavioral classification**
  2. **Direct and indirect cost**
  3. **Product cost and period cost**
  4. **Relevant and irrelevant cost**
  5. **Real cost**
  6. **Opportunity cost**

Cost Behavioral Patterns

1. Level of Activity
2. Basic Principle
3. Patterns of Cost Behavior

1. Level of Activity

- This refers to the **amount of work done** or the number of **events** that have occurred.
- Depending on circumstances, **level of activity** may refer to;
  - ✓ the **volume of production** in a period,
  - ✓ number of **items** sold,
  - ✓ value of **items** sold,
  - ✓ number of **invoices** issued or received,
  - ✓ number of units of **electricity** consumed,
  - ✓ labor **turnover**, etc.
- Level of activity is simply in relation to **quantity of product** or **service** and is normally presented as the **independent variable** on a graph.

2. Basic Principle

- The basic principle of cost behavior is that as the level of **activity rises**, cost will **usually rise**.
- **Naturally**, it will cost more to produce 400 units of output than it will cost to produce 200 units.
- The **problem** for the accountant to solve, however, is to determine for each item of cost:
  a. In what way do costs rise; and
  b. By how much, as the level of activity increases?

3. Patterns of Cost Behavior

- **Mixed cost** can be basically categorized into two: **fixed** and **variable costs**.
- **Fixed cost**, **variable cost** and **mixed cost** behave differently in response to **changes** in levels of activity.

a. Fixed Cost

- This is the cost which **tends to be unaffected** by increase or decrease in the **volume of output**.
- Is a **period cost** in that it relates to a span of time and not to the level of activity, in the short run.
- Total fixed cost (TFC), therefore, would **remain unchanged,** no matter the level of activity.
- **Fixed cost per unit**, however, would be decreasing as activity level increases.

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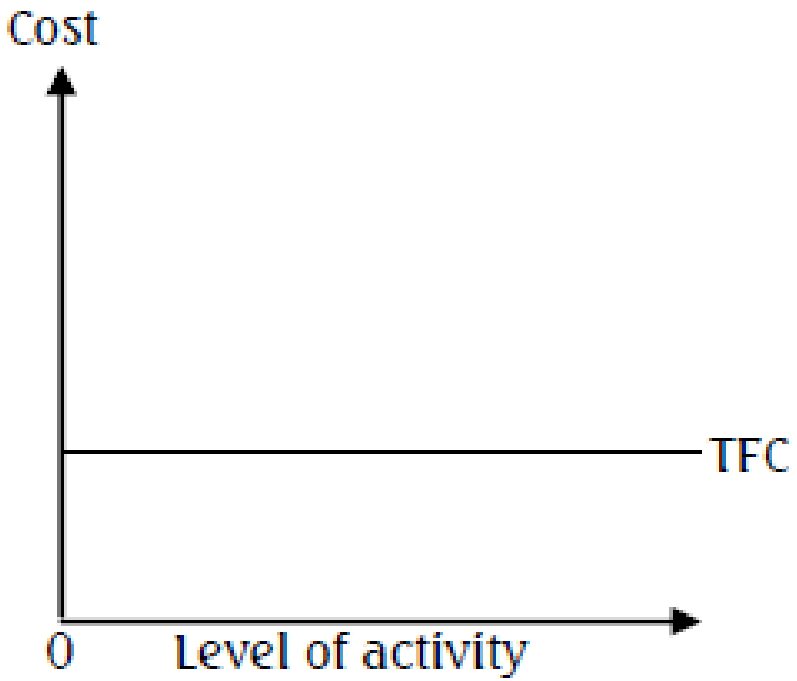
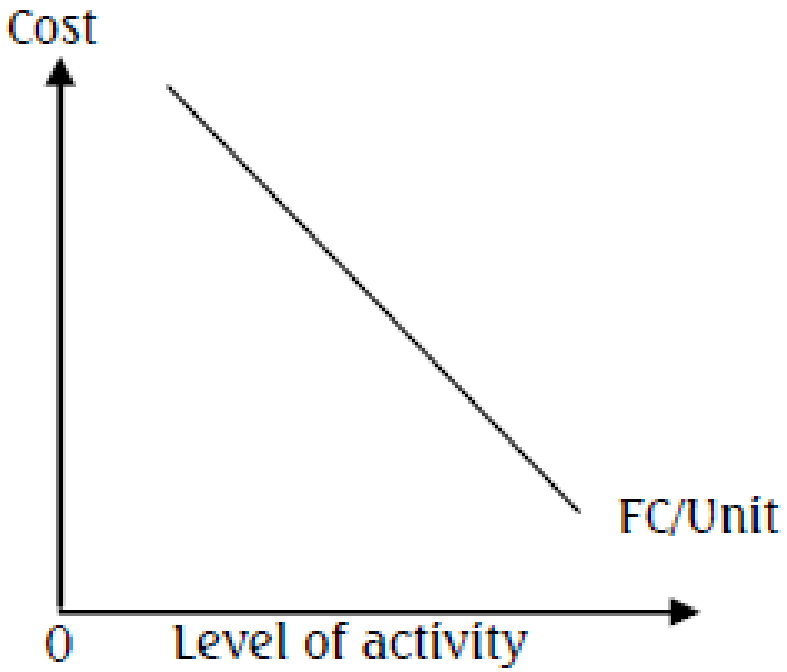
The graphs below illustrate the relation between **fixed cost**, **fixed cost per unit** and **level of activities**.





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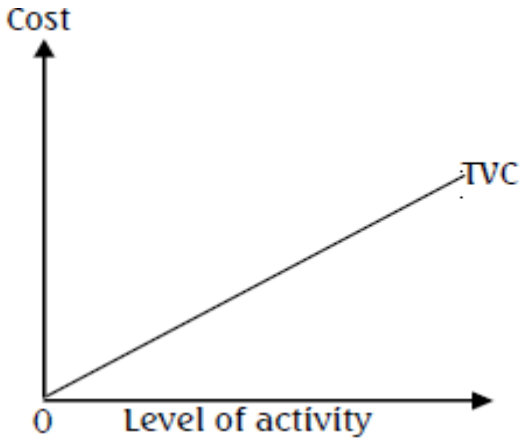
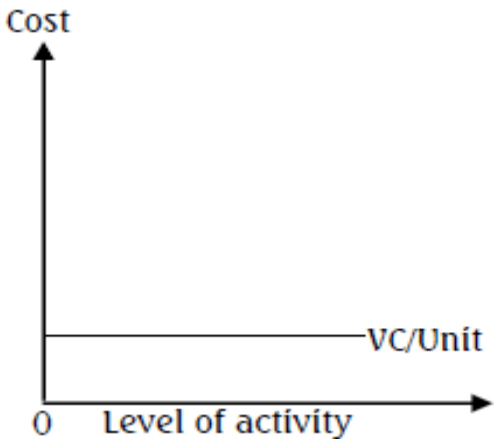
- An important **behavioral pattern** of fixed costs is that **total fixed cost remains constant** but **fixed cost per unit decreases** with increase in volume of output and vice versa.
- This shows that fixed cost per unit and volume are inversely related.
- Examples of **fixed cost** are:
  i. Salary of Managing Director;
  ii. The rent of a factory building; and
  iii. Straight-line depreciation of a machine, etc.

b. Variable Cost

- This is the cost which **varies directly** with the volume of output.
- **Variable cost per unit**, however, is the **same** for each unit produced, that is, it **remains unchanged** no matter the level of activity, in the short run.
- Below are graphs that illustrate this concept.





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- When level of activity **is zero**, there will be no variable cost.
- As the **level of activity rises** from 1 upward, total variable cost (given by variable cost/unit x the number of units) would rise.
- As **activity level** decreases, total variable cost (TVC) will also decrease.
- The relationship between TVC and level of activity **is direct**.
- **Variable cost per unit**, however, would **remain unchanged,** in the short-run, no matter the level of activity.

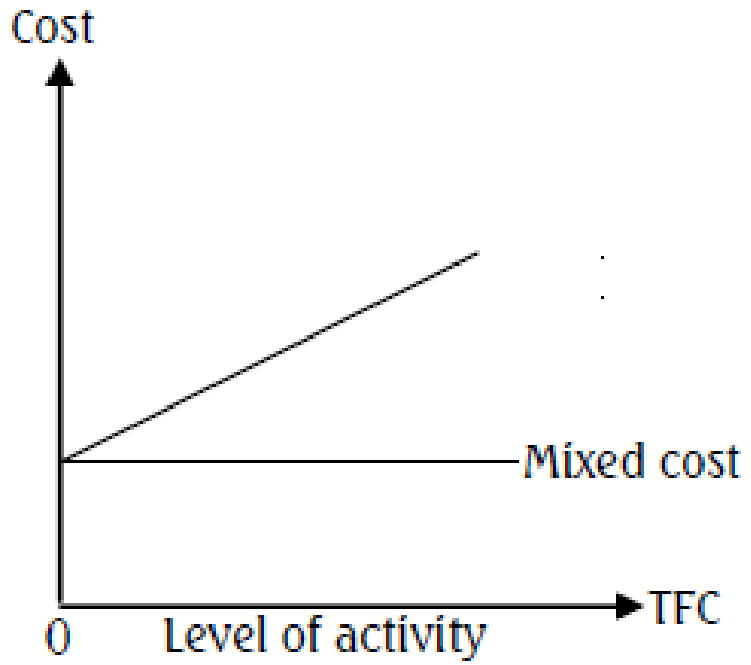
Examples of variable cost

i. Cost of raw materials (where there is no quantity discount);
ii. Cost of direct labor;
iii. Sales commission; and
iv. Bonus payments after achieving a certain performance level.

c. Mixed Cost

- This is also referred to as **total cost**, **full cost**, **semi-variable** or **semi-fixed cost**.
- **Examples** of Mixed cost
  i. Electricity bills
  ii. Telephone bills, etc.

Graphical illustration of mixed cost



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- **Mixed cost** behave in the same way as **variable cost**, that is, showing direct relationship with level of output.
- The **major difference** between the two is that whereas TVC starts from zero level, mixed cost starts from TFC level.
- **Mixed costs** are simply defined as costs in which there is a **standing basic charge** and a **variable charge** per unit of consumption.

d. Step Costs

- Many items of cost might be seen as **fixed cost** in nature within **certain levels of activity** only.
- For example, **depreciation charge** on machine may be fixed if production remains within the capacity of one machine.
- If more units are to be produced to satisfy increasing demand, another machine has to be purchased and the depreciation on the second machine would make **total depreciation charge to go up a step**.

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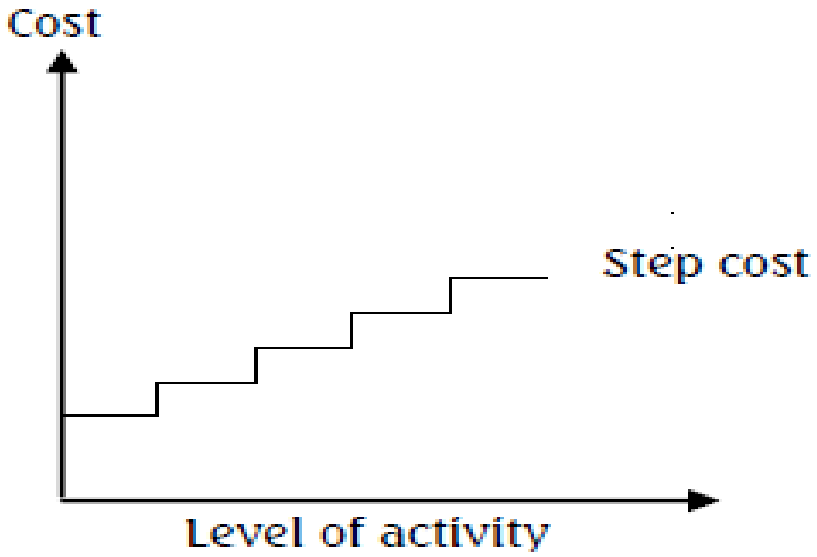
Step costs are fixed costs that are subject to **gradual changes** in response to abnormally high productivity.
Graphically, they form the **pattern of a ladder**.



Other **examples** of step cost are:

i. **Rent**, where accommodation requirements increases as output levels get higher; and
ii. **Basic salaries**, where more employees are employed on account of demand for increase in output.

Cost Estimation

- It is often assumed that within the **normal range of output**, costs are **variable**, **fixed** or **mixed.**
- **Step costs** are fixed within a certain range.
- For this reason, **cost accountants** usually treat all costs as **fixed** or **variable**, and **mixed costs** are segregated into their fixed and variable elements.
- There are **several ways** in which fixed costs elements and variable cost elements within **mixed cost** may be **estimated**.
- Each **way/method** is only an estimate, and would, therefore, give **different results** from other methods.

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Some of the **estimation methods** are:

a. High-low method;

b. **Scatter-graph** (which is about putting cost on Y-axis and Volume of output on X-axis and then drawing a line of best fit through the points of intersection); and

c. **Statistical analysis** (simple regression or multiple regression analysis).

a. The High-Low Method

- This method of segregating costs into their fixed and variable elements is **simple** and **crude** as it relies on **two extreme points** (the highest and the lowest levels of activities).
- It may **not be very representative** of the data.
- Since this and other methods are emphasizing on estimation to be used in **guiding decision making** pertaining to cost elements.

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Mathematically

a. Total Cost (TC) of **High output** = FC + VC (of highest level of activity);

b. Less: TC of **Low output** = FC + VC (of lowest level of activity);

c. Equals **difference in variable cost**, because the fixed cost is the same at each level of activity;

d. The **variable cost per unit** = Difference In VC (as FCs have cancelled themselves) divided by Difference In output; and

e. Using the **High output**, Fixed Cost = TC – (VC/Unit x No. of Units at this level).

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Pro-forma of high-low method

	Output	Total Cost
• High	xxx	xxx
• Low	xxx	xxx
• Difference	xx	xx

$$VC/Unit = \frac{xx}{x} = xx$$

Example

The operating costs of **Afro Master Limited**, a firm of electronics manufacturers, for the last six (6) months are as follows:

Month	Cost ($m)	Production Volume ($m)
1	250	15.0
2	**260**	**18.5**
3	**220**	**14.5**
4	255	15.1
5	258	15.3
6	230	14.8

Required

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a. Using the **high-low method** of cost estimation; determine the **total fixed cost**, **variable cost per unit** and **the cost function**.

b. What should be the **cost in month 7** when output is expected to be 13,000 units of electronics?

Solution

a. From the data above, the **highest level** of activity (which is accompanied by the highest total cost) is in month 2 and the **lowest level** of activity is in month 3 and, therefore, they are the two required **extreme points.**

	Output	TC
• High	18,500	260,000,000
• Low	14,500	220,000,000
• Difference	4,000	40,000,000

$$\text{VC/Unit} = \frac{40{,}000{,}000}{4{,}000} = \$10{,}000$$

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- Using the **highest level**:
- **Fixed Cost** = 260,000,000 – ($10,000 x18,500)
  = 260,000,000 – 185,000,000
  = $75,000,000
- **Cost Function** = $10,000X + $75,000,000
  TVC + TFC

b. To determine what the **cost should be in month 7**, we use the cost function developed above and substitute for x:

- **TC in month 7** = $10,000 x 13,000 + $75,000,000
  = $130,000,000 + $75,000,000
  = $205,000,000

Marginal Costing

- „**Marginal Cost**“-is the cost which arises from the production of **additional increments of output**.
- “It is the amount at any given volume of output by which **aggregate cost is changed** if the volume of output increase or decrease by one unit” (CIMA).
- In the words of Chartered Accountants of England and Wales, “**Marginal Cost** is every expense (whether of production, selling or distribution) incurred by making a **particular decision**”.

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- **Marginal costs** are synonymous with **variable cost,** that is, prime costs and variable overheads, in the short run but, in long run would also include **fixed costs**.
- Thus, **marginal costs** are related to change in output under particular circumstance of a case.
- According to the Chartered Institute of Management Accountants, "**marginal costing** is the ascertainment, by differentiating between fixed costs and variable costs, of marginal costs and of the effect on profit or changes in the volume and type of output".

Standard Costing And Variance Analysis

Standard Costing

a. **Standard Costing** is defined as a **control technique** which **compares** standard costs and revenues with actual results to obtain **variances** which are used to stimulate improved performance.

b. Is defined as a **pre-determined** calculation of how much costs should be under specified working conditions.

Setting Standards

a. It is determined in advance of the **actual costs**.

b. It is set based on prescribed set of **working conditions**.

c. It is arrived at by **correlating quantity** of materials and labor with the prices and wage rates.

d. It is applied to some areas of management needs, that is, **controls**, **stock valuation**, and possibly also **fixing selling prices.**

e. When used for control purposes, a comparison is made of predetermined costs with actual cost. The result of this comparison is **identification of variances** which are then reported to management for corrective actions, if necessary.

Types Of Standard

a. Attainable Standard;

b. Ideal Standard;

c. Loose Standard;

d. Basic Standard; and

e. Current Standard.

Source of Information for Setting Standards

- **Materials** - Product specification after an intensive study of the input quantity necessary for each unit of output.
- **Prices** -These are obtainable from the Purchasing Department after a careful market survey of prices.
- **Labor** - Machine Manufacturer‟s specification of time required to achieve production.
- **Labor Rate** - Company‟s Standard Wage rate or negotiated wage rate with Trade Union
- **Overhead** - Company's pre-determined overhead absorption rates

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Thus, a Standard cost is arrived at as follows:

	Qty	Price	=	Cost
Material	x	x	=	x
Labor	x	x	=	x
Variable overhead	x	x	=	x
Fixed production overhead	x	x	=	x
Standard production cost				x

Variance Analysis

- The **major application** of Standard Costing is for controls, through variance analysis and reporting.
- **A Variance** is simply the difference between **planned** or **budgeted** costs and **actual** costs and similarly in respect of revenues.
- **Variance Analysis** is the analysis of variances in a standard costing system into their constituent parts.
- It is the **analysis** and **comparison** of the factors which have caused the difference between pre-determined standards and actual results with a view to **eliminating inefficiencies**.

Possible Causes Of Variances

- The following are the more **common factors** attributed at variances in manufacturing concerns.

a. Material Price - Buying materials at a price different from the specified buying price.

i. Inefficiency of the **purchasing department** in seeking the most advantageous sources of supply.

ii. Changes in **market condition** causing general price increase.

iii. Purchase of inferior (or superior) **quality** materials.

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b. Material Usage - Using more or less quantities of material than those specified to achieve the actual production.

i. **Careless handling** of materials by the production workers.

ii. Purchase of **inferior quality** materials.

iii. Changes in **method** of production.

c. Labor Rate - Paying labor at a rate different from the agreed rate.

i. **Assignment of work** to higher grade labor.

ii. Negotiated increase in **wage rates** not reflected in the standard wage rate.

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d. Labor Efficiency - The work force spending more or less time than allowed for the actual production.

i. Waste of time due to use of **inferior quality** materials.

ii. Use of **different grade** of labor from that specified.

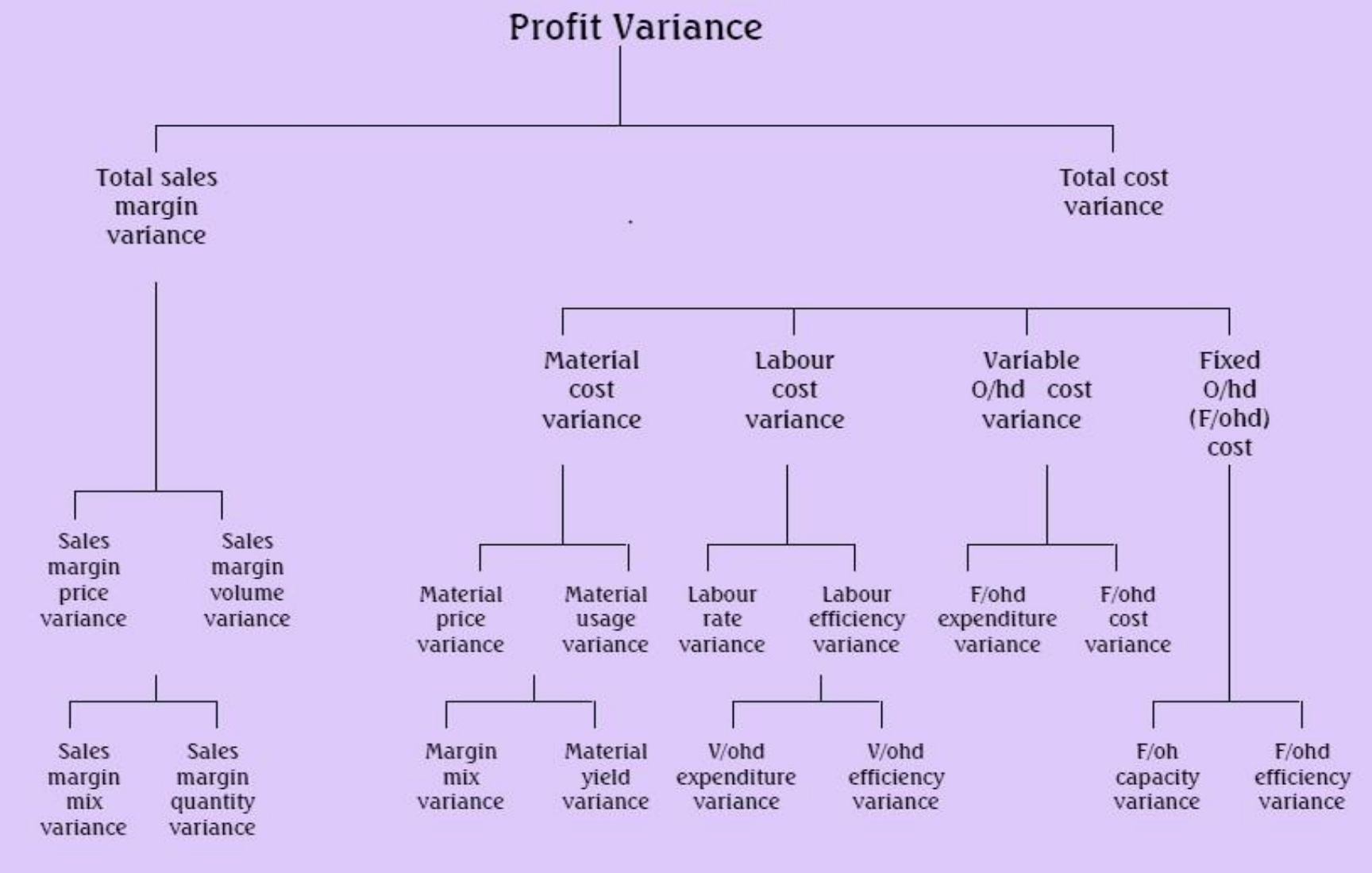
iii. Waste of time due to **failure to maintain machines** in proper conditions.

e. Overhead - Since the Recovery Rates are always based on budgeted figures, any deviation from budget will give rise to a variance.

i. Actual **expenditure** being different from the budgeted expenditure.

ii. Actual **production** being different from the budgeted production.

The Pyramid Of Variances



Budgeting Control

What is a Budget?

- The term budget has been defined in several ways, each emphasizing the issues of **planning** and **control** of future activities.
- Is a process of setting **performance standard** for future activities so as to **exercise control** (on cost, revenue, income and other financial or non-financial activities).
- It could also be viewed as a means of obtaining **accountability** and **control** over the use of money or over all activities.

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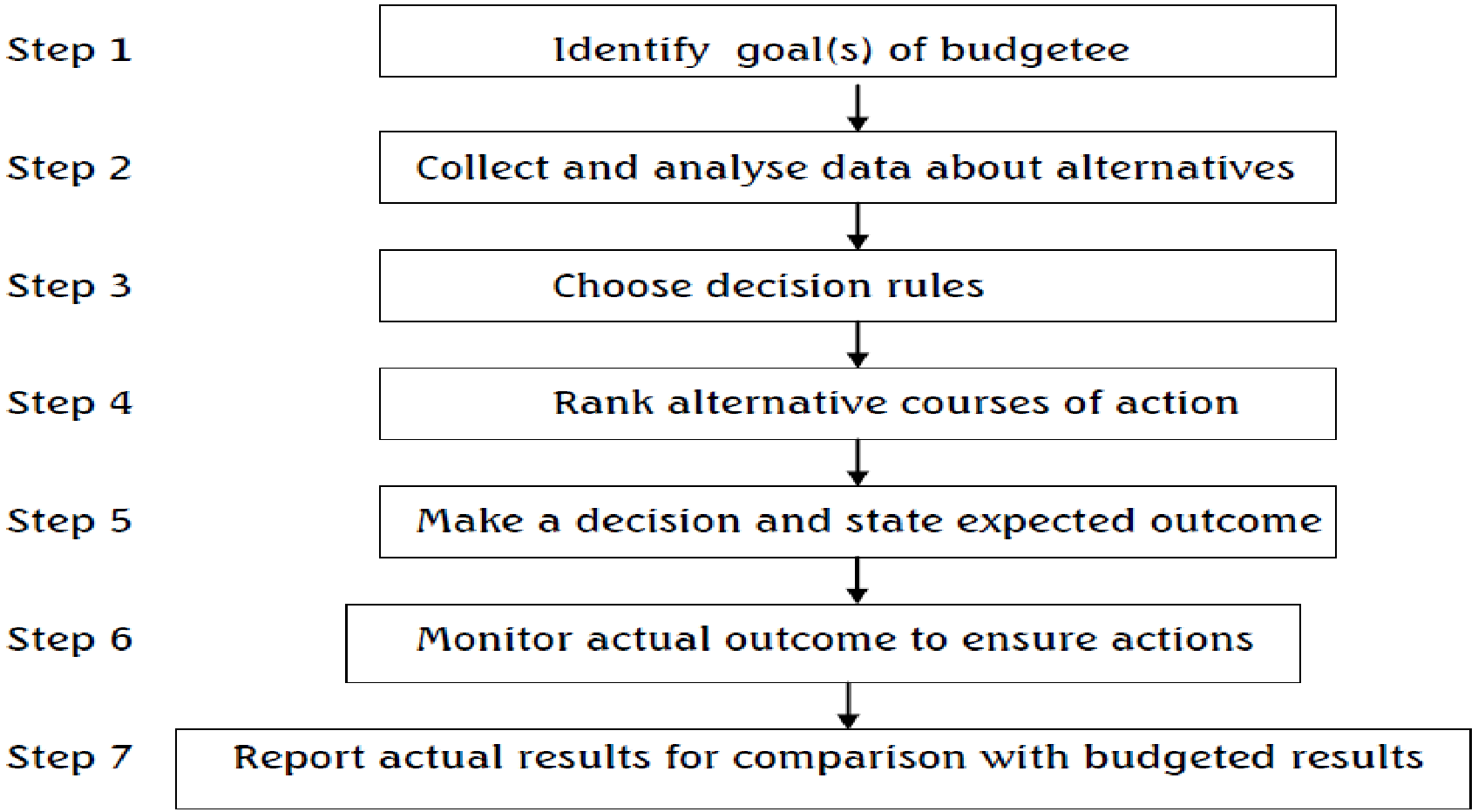
- The Institute of Cost and Management Accountants (ICMA) defined **budget** as a plan quantified in **monetary terms**, prepared and approved prior to a defined period of time.
- **Budget** could also be defined as an exercise in **communication** by which the expectations of management about levels of performance of subordinates are communicated to the subordinates.

Budgeting Framework (Process)

Budgets are to be prepared within a **given framework**. The process of budgeting entails passing through some steps,



Budget Limiting Factors

- Interdependency,
- Market,
- Political,
- Economic,
- Social,
- Legal, and
- Technological circumstances

General Purposes Of Budget

1. Accountability and Control
2. Management
3. Planning
4. Economic Policies

Budgetary Control Process

1. Establishment of Objectives
2. Budget Centers
3. Budget Co-ordination
4. Budgets Approval
5. Measurement of Actual Performance
6. Feedback Actions

Types Of Budget

1. Time perspective

a. Short-term budget:
b. Medium-term budget
c. Long-term budget

2. Activities perspective

a. Operating Budgets:
b. Financial Budget:
c. Master Budget:

3. Quantitative perspective

a. Surplus Budget:
b. Deficit Budget:
c. A Balanced Budget:

Budgetary Improvement Techniques

1. Incremental Budgeting (IB);
2. Zero Based Budgeting (ZBB);
3. Continuous (Rolling) Budgeting (CB); and
4. Planning Programming Budgeting System (PPBS).

Incremental Budgeting (IB)

- **Advantages of Incremental Budgeting**

a. Moderation of conflicts:
b. Reduction of cost:
c. Saving of time:

- **Disadvantages of Incremental Budgeting**

a. Future cost implication ignored:
b. Transferring inefficiency to the future:
c. Provision of poor information:
d. No evaluation of alternatives:
e. Lack of budget expertise:
f. Flexible budgeting ignored:

Zero Based Budgeting (ZBB)

- Major **Steps** of ZBB

a. Breaking down **each activity** or **project** into **decision packages**. decision package is a document containing information about:

   i. **Cost-benefit-analysis** on a proposal;

   ii. A comparison of the **result of the analysis** with those of other alternatives; and

   iii. The **consequences** of not approving the proposal.

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b. Comprehensive evaluation of **various alternative courses of action** to a **proposed activity** or **project** and ranking of the **proposals** in order of **decreasing benefit** or importance to the organization.

c. Allocation of **resources** to the competing projects or activities in accordance with the **final ranking** established.

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➢ Advantages of ZBB

a. Availability of alternatives:
b. Future cost Implications of decisions are considered:
c. Elimination of low priority programs:
d. Creativity and initiative enhanced:

➢ Disadvantages of ZBB

a. Conflict of Interest:
b. High Cost:
c. Time Wasting:
d. Difficulty of Understanding:
e. High Level of Paper work:

END OF CHAPTER EIGHT