

ACTIVITY BASED COSTING

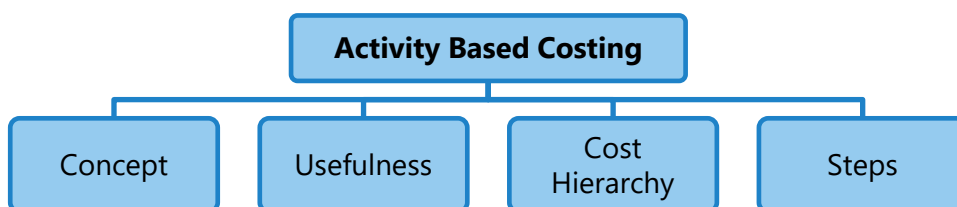


LEARNING OUTCOMES

After studying this chapter, you would be able to-

- ◆ Discuss problem of Traditional Costing System.
- ◆ Discuss usefulness of Activity Based Costing (ABC).
- ◆ Discuss Cost Allocation under ABC.
- ◆ Discuss Different level of activities under ABC.
- ◆ Understand stages, advantages, and limitations of ABC.
- ◆ Discuss various requirements in ABC implementation.
- ◆ Explain the concept of Activity Based Management (ABM).
- ◆ Explain the concept of Activity Based Budgeting (ABB).

CHAPTER OVERVIEW





1. INTRODUCTION

As discussed in chapter 4 i.e. Overhead, in Traditional Costing System, overhead costs are grouped together under cost center and then absorbed into product costs on either of the basis such as direct labour hours, machine hours, volume etc. In certain cases, this traditional costing system gives inaccurate cost information. Though, it should not be assumed that all traditional absorption costing systems are not accurate enough to give adequate information for pricing purposes or other long-run management decision purposes. Some traditional systems treat overheads in a detailed way and relate them to service cost centres as well as production cost centres. The service centre overheads are then spread over the production cost centres before absorption rates are calculated. *The main cause of inaccuracy is in the calculation of the overhead rate itself, which is usually based on direct labour hours or machine hours. These rates assume that products that take longer to make, generate more overheads and so on.*

Organisations, who do not wish to know how much it costs to make a product with precise accuracy, may be happy with traditional costing system. Others, however, fix their price on cost basis and need to determine it with reasonable accuracy. The latter organisations have been greatly benefitted from the development of activity-based costing (ABC), which is considered as a modern absorption costing method, and was evolved to give more accurate product costs.

1.1 Factors prompting the development of ABC

Various factors lead to the development of ABC include:

1. Growing overhead costs because of increasingly automated production
2. Increasing market competition, which necessitated more accurate product costs.
3. Increasing product diversity to secure economies of scope & increased market share.
4. Decreasing costs of information processing because of continual improvements and increasing application of information technology.

1.2 Usefulness/Suitability of ABC

ABC is particularly needed by organisations for product costing in the following situations:

1. **High amount of overhead:** When production overheads are high and form significant costs, ABC is more useful than traditional costing system.
2. **Wide range of products:** ABC is most suitable, when, there is diversity in the product range or there are multiple products.
3. **Presence of non-volume related activities:** When non-volume related activities e.g. material handling, inspection set-up, are present significantly and traditional system cannot be applied, ABC is a superior and better option. ABC will identify non-value-adding activities in the production process that might be a suitable focus for attention or elimination.
4. **Stiff competition:** When the organisation is facing stiff competition and there is an urgent requirement to compute cost accurately and to fix the selling price according to the market situation, ABC is very useful. *ABC can also facilitate in reducing cost by identifying non-value-adding activities in the production process that might be a suitable focus for attention or elimination.*



2. MEANING AND DEFINITION

Activity Based Costing is an accounting methodology that assigns costs to activities rather than products or services. This enables resources & overhead costs to be more accurately assigned to products & services that consume them. **ABC is a technique which involves identification of cost with each cost driving activity and making it as the basis for apportionment of costs over different cost objects/ jobs/ products/customers or services.**

ABC assigns cost to activities based on their use of resources. It then assigns cost to cost objects, such as products or customers, based on their use of activities. ABC can track the flow of activities in organization by creating a link between the activity (resource consumption) and the cost object.

CIMA defines 'Activity Based Costing' as *"An approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities, and activities to cost objects based on consumption estimates. The latter utilise cost drivers to attach activity costs to outputs."*



3. MEANING OF TERMS USED IN ABC

- (i) **Activity:** Activity, here, refers to an *event that incurs cost*.
- (ii) **Cost Object:** It is *an item for which cost measurement is required* e.g. a product or a customer.
- (iii) **Cost Driver:** It is a *factor that causes a change in the cost of an activity*. There are two categories of cost driver.
 - **Resource Cost Driver:** It is a measure of the *quantity of resources* consumed by an activity. It is used to assign the cost of a resource to an activity or cost pool.
 - **Activity Cost Driver:** It is a measure of the *frequency and intensity of demand*, placed on activities by cost objects. It is used to assign activity costs to cost objects.
- (iv) **Cost Pool:** It represents a group of various individual cost items. It consists of costs that have same cause and effect relationship. Example machine set-up.

Examples of Cost Drivers:

Business Functions	Cost Driver
Research and Development	• Number of research projects • Personnel hours on a project
Design of products, services and procedures	• Number of products in design • Number of parts per product • Number of engineering hours
Customer Service	• Number of service calls

	• Number of products serviced • Hours spent on servicing products
Marketing	• Number of advertisements • Number of sales personnel • Sales revenue
Distribution	• Number of units distributed • Number of customers



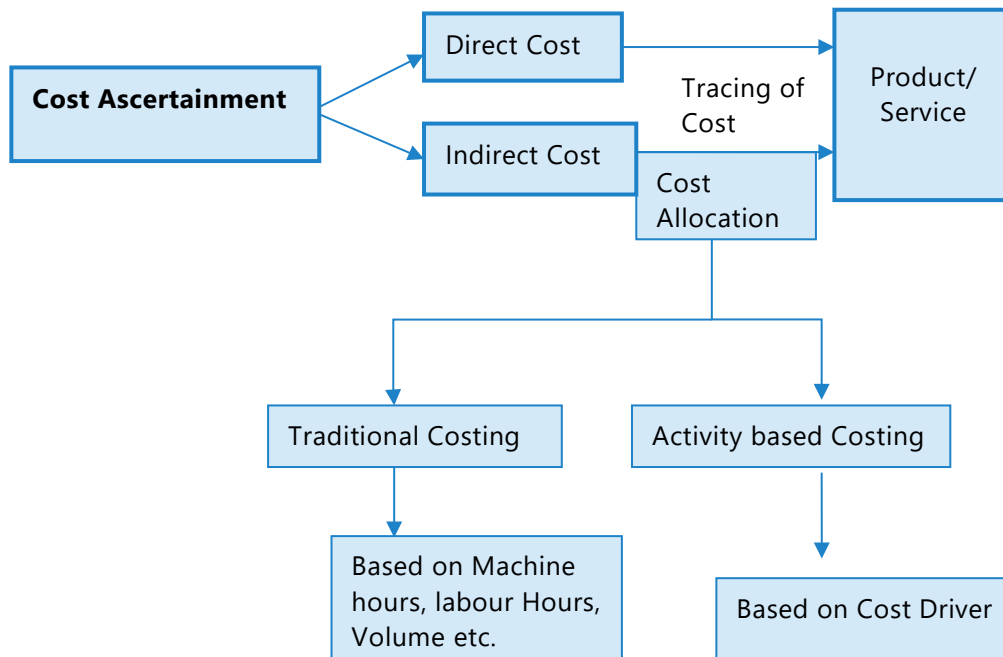
4. COST ALLOCATION UNDER ABC

Under activity based cost allocation overheads are attributed to products on the activity base. Traditionally, overhead costs are grouped together under cost centre and then absorbed into product costs on some basis such as direct labour hours. Activity based costing identifies the activities which cause cost to be incurred and searches for fundamental cost drivers of these activities. Once the activities and there cost drivers have been identified this information can be used to assign overheads to cost objects (e.g. products) which have actually caused cost to be incurred.



5. TRADITIONAL ABSORPTION COSTING VS ABC

Cost Allocation under Traditional and Activity Based Costing system



Cost Allocation under Traditional and Activity Based Costing System

In traditional absorption costing overheads are first related to cost centres (Production & Service Centres) and then to cost objects, i.e., products. *In ABC overheads* are related to activities or grouped into cost pools. Then they are related to the cost objects, e.g., products. The two processes are, therefore, very similar, but the first stage is different, as ABC uses activities instead of functional departments (cost centres). The problem with functional departments is that they tend to include a series of different activities, which incur a number of different costs that behave in different ways. Activities also tend to run across functions; for instance, procurement of materials often includes raising a requisition note in a manufacturing department or stores. It is not raised in the purchasing department where most procurement costs are incurred. Activity costs tend to behave in a similar way to each other i.e., they have the same cost driver. Therefore, ABC gives a more realistic picture of the way in which costs behave.

Difference between Activity Based Costing and Traditional Absorption Costing

Activity Based Costing	Traditional Absorption Costing
1. Overheads are <i>related to activities</i> and grouped into activity cost pools.	1. Overheads are <i>related to cost centers/departments</i> .
2. Costs are related to activities and hence are <i>more realistic</i> .	2. Costs are related to cost centers and hence not realistic of cost behaviour.
3. Activity-wise cost drivers are <i>determined</i> .	3. Time (Hours) are <i>assumed</i> to be the only cost driver governing costs in all departments.
4. Activity-wise recovery rates are determined and there is no concept of a single overhead recovery rate.	4. Either multiple overhead recovery rates (for each department) or a single overhead recovery rate may be determined for absorbing overheads.
5. Cost are assigned to cost objects , e.g. customers, products, services, departments, etc.	5. Costs are assigned to Cost Units i.e. to products, or jobs or hours.
6. <i>Essential activities can be simplified and unnecessary activities can be eliminated</i> . Thus, the corresponding costs are also reduced/ minimized. Hence ABC aids cost control.	6. <i>Cost Centers/ departments cannot be eliminated</i> . Hence, not suitable for cost control.



6. LEVEL OF ACTIVITIES UNDER ABC METHODOLOGY/COST HIERARCHY

These categories are generally accepted today, but were first identified by Cooper (1990). The categories of activities help to determine the type of activity cost driver required.

The categories of activities are:

Level of Activities	Meaning	Example
1. Unit level activities	These are those activities for which the consumption of resources can be identified with the number of units produced.	- The use of indirect materials/consumables tends to increase in proportion to the number of units produced. - The inspection or testing of every item produced, if this was deemed necessary or, perhaps more likely, every 100th item produced.
2. Batch level activities	The activities such as setting up of a machine or processing a purchase order are performed each time a batch of goods is produced. The cost of batch related activities varies with number of batches made, but is common (or fixed) for all units within the batch.	- Material ordering—where an order is placed for every batch of production - Machine set-up costs—where machines need resetting between each different batch of production. - Inspection of products where the first item in every batch is inspected rather than every 100th item quoted above.
3. Product level activities	These are the activities which are performed to support different products in product line	- Designing the product, - Producing parts specifications - Keeping technical drawings of products up to date.

4. Facilities level activities	These are the activities which cannot be directly attributed to individual products. These activities are necessary to sustain the manufacturing process and are common and joint to all products manufactured	• Maintenance of buildings • Plant security
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7. STAGES IN ACTIVITY BASED COSTING (ABC)

The different stages in ABC calculations are listed below:

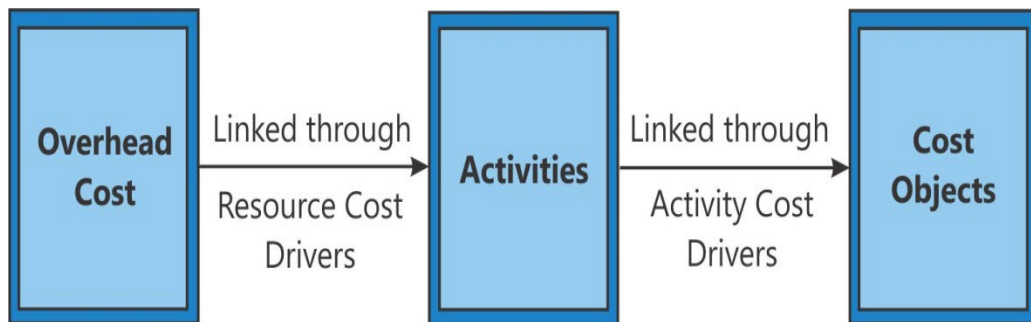
- (1) **Identify the different activities within the organisation:** Usually the number of cost centres that a traditional overhead system uses is quite small, say up to fifteen. In ABC, the number of activities will be much more, say 200; the exact number will depend on how the management subdivides the organisation's activities. *It is possible to break the organisation down into many very small activities.* But if ABC is to be acceptable as practical system it is necessary to use larger groupings, say, 40 activities may be used in practice. The additional number of activities over cost centres means that ABC should be more accurate than the traditional method regardless of anything else. Some activities may be listed as follows:-

- Production schedule changes
- Customer liaison
- Purchasing
- Production process set up
- Quality control
- Material handling
- Maintenance

- (2) **Relate the overheads to the activities**, both support and primary, that caused them. This creates '**cost pools**' or '**cost buckets**'. This will be done using resource cost drivers that reflect causality.
- (3) **Support activities are then spread across the primary activities** on some suitable base, which reflects the use of the support activity. The base is the cost driver that is the measure of how the support activities are used.
- (4) **Determine the activity cost drivers** that will be used to relate the overheads collected in the cost pools to the cost objects/products. This is based on the factor that drives the consumption of the activity. The question to ask is – what causes the activity to incur costs? In production scheduling, for example, the driver will probably be the number of batches ordered.
- (5) **Calculate activity cost driver rates for each activity**, just as an overhead absorption rate would be calculated in the traditional system.

$$\text{Activity cost driver rate} = \frac{\text{Total cost of activity}}{\text{Activity driver}}$$

The activity driver rate can be used not only to identify cost of products, as in traditional absorption costing, but it can also be used for costing other cost objects such as customers/customer segments and distribution channels. The possibility of costing objects other than products is part of the benefit of ABC. The activity cost driver rates will be multiplied by the different amounts of each activity that each product/other cost object consumes.



Cost allocation under ABC

Let us take a small example to understand the steps stated above:

Assume that a company makes widgets and the management decides to install an ABC system. The management decides that all overhead costs will have only three cost drivers viz. direct labour hours, machine hours and number of purchase orders. The general ledger of the company shows the following overhead costs –

General Ledger	(₹)
Perquisite taxes	1,000
Machine maintenance	500
Purchasing Dept. labour	4,000
Fringe benefits	2,000
Purchasing Dept. Supplies	250
Equipment depreciation	750
Electricity	1,250
Employees' group insurance	1,500
Total	11,250

So, which overheads do you think are driven by direct labour hours?

The answer is

Perquisite taxes	₹ 1,000
Fringe benefits	₹ 2,000
Employees' group insurance	₹ 1,500
Total	₹ 4,500

Similarly, overheads driven by machine hours include Machine maintenance, depreciation and electricity, totaling ₹ 2,500 and finally overheads driven by number of purchase orders include purchasing department labour and purchasing department supplies, totaling ₹ 4,250.

Now, overhead rate is calculated by the formula

Total cost in the activity pool ÷ Base,

base being the total number of labour hours, machine hours and total number of purchase orders in the given case.

Assume that the total number of labour hours be 1,000 hours, machine hours be 250 hours and total purchase orders be 100 orders.

So, Cost driver rate would be

Cost Driver Rate	(₹)
₹ 4,500/ 1,000	₹ 4.50 per labour hour
₹ 2,500/ 250	₹ 10 per machine hour
₹ 4,250/ 100	₹ 42.50 per purchase order

Now, let's allocate the overheads between two widgets A and B the details of which are given below:

Particulars	Widget A	Widget B
Labour hours	400	600
Machine Hours	100	150
Purchase Orders	50	50

So, total overhead costs applied to widget A = $(400 \times ₹ 4.50) + (100 \times ₹ 10) + (50 \times ₹ 42.50) = ₹ 4,925$

And total overheads applied to widget B = $(600 \times ₹ 4.50) + (150 \times ₹ 10) + (50 \times ₹ 42.50) = ₹ 6,325$

So total overheads = ₹ 4,925 + ₹ 6,325 = ₹ 11,250.

Generally, in the traditional costing method, overheads are applied on the basis of direct labour hours (total 1,000 labour hours in the given case). So, in that case the overhead absorption rate would be – $₹ 11,250/1000 = ₹ 11.25$ per hour and the total overheads applied to Widget A would have been = $400 \times ₹ 11.25 = ₹ 4,500$ and to Widget B = $600 \times ₹ 11.25 = ₹ 6,750$.

Hence Widget A would have been under-valued and Widget B over-valued by ₹ 425.

Examples of Cost Drivers

Some of the examples of cost drivers for different activity pools in a production department are stated below:

Activity Cost Pools	Related Cost Drivers
Ordering and Receiving Materials cost	Number of purchase orders
Setting up machines costs	Number of set-ups
Machining costs	Machine hours
Assembling costs	Number of parts
Inspecting and testing costs	Number of tests
Painting costs	Number of parts
Supervising Costs	Direct labour hours

The process of calculating cost driver rate is illustrated in diagrammatic presentation as below:

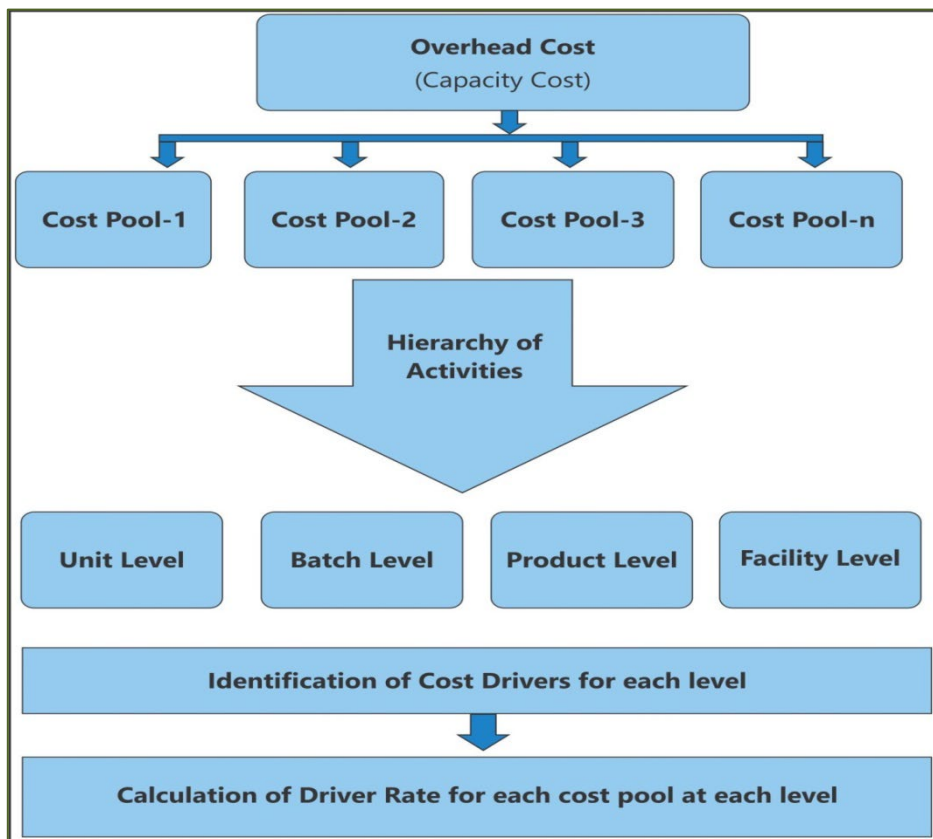


ILLUSTRATION 1

ABC Ltd. is a multiproduct company, manufacturing three products A, B and C. The budgeted costs and production for the year ending 31st March are as follows:

	A	B	C
Production quantity (Units)	4,000	3,000	1,600
Resources per Unit:			
- Direct Materials (Kg.)	4	6	3
- Direct Labour (Minutes)	30	45	60

The budgeted direct labour rate was ₹ 10 per hour, and the budgeted material cost was ₹ 2 per kg. Production overheads were budgeted at ₹ 99,450 and were absorbed to products using the direct labour hour rate. ABC Ltd. followed the Absorption Costing System.

ABC Ltd. is now considering to adopt an Activity Based Costing system. The following additional information is made available for this purpose.

1. **Budgeted overheads were analysed into the following:**

	(₹)
Material handling	29,100
Storage costs	31,200
Electricity	39,150

2. **The cost drivers identified were as follows:**

Material handling	Weight of material handled
Storage costs	Number of batches of material
Electricity	Number of Machine operations

3. **Data on Cost Drivers was as follows:**

	A	B	C
<i>For complete production:</i>			
<i>Batches of material</i>	10	5	15
<i>Per unit of production:</i>			
<i>Number of Machine operations</i>	6	3	2

You are requested to:

1. *PREPARE a statement for management showing the unit costs and total costs of each product using the absorption costing method.*
2. *PREPARE a statement for management showing the product costs of each product using the ABC approach.*
3. *STATE what are the reasons for the different product costs under the two approaches?*

SOLUTION**1. Traditional Absorption Costing**

	A	B	C	Total
(a) Quantity (units)	4,000	3,000	1,600	8,600
(b) Direct labour (minutes)	30	45	60	-
(c) Direct labour hours (a × b)/60 minutes	2,000	2,250	1,600	5,850

Overhead rate per direct labour hour:

= Budgeted overheads ÷ Budgeted labour hours

= ₹ 99,450 ÷ 5,850 hours

= ₹ 17 per direct labour hour

Unit Costs:

	A (₹)	B (₹)	C (₹)
Direct Costs:			
- Direct Labour	5.00	7.50	10.00
- Direct Material	8.00	12.00	6.00
Production Overhead:	8.50 $\left(\frac{₹ 17 \times 30}{60} \right)$	12.75 $\left(\frac{₹ 17 \times 45}{60} \right)$	17.00 $\left(\frac{₹ 17 \times 60}{60} \right)$
Total unit costs	21.50	32.25	33.00
Number of units	4,000	3,000	1,600
Total costs	86,000	96,750	52,800

2. Activity Based Costing

	A	B	C	Total
Quantity (units)	4,000	3,000	1,600	-
Material Weight per unit (Kg.)	4	6	3	-
Total material weight	16,000	18,000	4,800	38,800
Machine operations per unit	6	3	2	-
Total operations	24,000	9,000	3,200	36,200
Total batches of Material	10	5	15	30

Material handling rate per kg. = ₹ 29,100 ÷ 38,800 kg.

= ₹ 0.75 per kg.

Electricity rate per machine operations = ₹ 39,150 ÷ 36,200

= ₹ 1.081 per machine operations

Storage rate per batch

= ₹ 31,200 ÷ 30 batches

= ₹ 1,040 per batch

Unit Costs:

	A (₹)	B (₹)	C (₹)
Direct Costs:			
Direct Labour	5.00	7.50	10.00
Direct material	8.00	12.00	6.00
Production Overheads:			
Material Handling	3.00 (₹0.75 × 4)	4.50 (₹0.75 × 6)	2.25 (₹0.75 × 3)
Electricity	6.49 (₹1.081 × 6)	3.24 (₹1.081 × 3)	2.16 (₹1.081 × 2)
Storage	2.60 $\left(₹10 \times \frac{₹1,040}{4,000} \right)$	1.73 $\left(₹5 \times \frac{₹1,040}{3,000} \right)$	9.75 $\left(₹15 \times \frac{₹1,040}{1,600} \right)$
Total unit costs	25.09	28.97	30.16
Number of units	4,000	3,000	1,600
Total costs	₹ 1,00,360	₹ 86,910	₹ 48,256

3. **Comments:** The difference in the total costs under the two systems is due to the differences in the overheads borne by each of the products. The Activity Based Costs appear to be more precise.



8. ADVANTAGES OF ACTIVITY BASED COSTING

The main advantages of using Activity Based Costing are:

- More accurate costing of products/services.
- Overhead allocation is done on logical basis.
- It enables better pricing policies by supplying accurate cost information.
- Utilizes unit cost rather than just total cost

- (v) Help to identify non-value added activities which facilitates cost reduction.
- (vi) It is helpful to the organizations with multiple products.
- (vii) It highlights problem areas which require attention of the management.



9. LIMITATIONS OF ACTIVITY BASED COSTING

The main limitations using Activity Based Costing are:

- (i) It is more expensive, particularly in comparison with traditional costing system.
- (ii) It is not helpful to the small organizations.
- (iii) It may not be applied to organizations with limited products.
- (iv) Selection of the most suitable cost driver may not be easy/ may be difficult or complicated.



10. REQUIREMENTS IN ABC IMPLEMENTATION

A number of distinct practical stages are required in the ABC implementation which are given as below:

- (1) Staff Training:** The co-operation of the workforce is critical to the successful implementation of ABC. Staff training should be done to create an awareness on the purpose of ABC.
- (2) Process Specification:** Informal, but structured interviews with key members of personnel will identify the different stages of the production process, the commitment of resources to each, processing times and bottlenecks.
- (3) Activity Definition:** The activities must be defined clearly in the early stage in order to manage the problems, if any, effectively. There might be overloading of information from the new data, but the same is needed in codification.
- (4) Activity Driver Selection:** Cost driver for each activity shall be selected.
- (5) Assigning Cost:** A single representative activity driver can be used to assign costs from the activity pools to the cost objects.



11. PRACTICAL APPLICATIONS OF ACTIVITY BASED COSTING

11.1 As a Decision-Making Tool

ABC can act as a decision making tool in the following ways:

- (i) ABC along with some other cost management technique can be utilized to improve performance and profitability of an organization.
- (ii) Wholesale distributors can gain significant advantage in the decision-making process through implementation of ABC concepts by correlating costs to various activities. Introduction of new product or vendor can be better decided through ABC.
- (iii) ABC can assist in decisions related to facility and resource expansion. Often the basis for relocation or opening of a new distribution center is based on **cost associations**. Reduction in freight or other logistic costs can offset the expense of the new facility, staff or equipment. The **ABC model** can identify the specific cost elements being targeted, providing a much clearer picture which aids in management actions.
- (iv) ABC augments decision support for human resources. Since the activity (and therefore costs) can be associated to an individual, new levels of financial performance can be determined. This might be evident in the case of branch management or sales.
- (v) Companies who wish to determine price based on cost plus markup basis find ABC method of costing very relevant and are able to determine competitive prices for their products.

11.2 As Activity Based Management

Meaning of Activity Based Management

The term Activity Based Management (ABM) is used to describe the cost management application of ABC. **The use of ABC as a costing tool to manage costs at activity level is known as Activity Based Management (ABM).** ABM is a discipline that focuses on the efficient and effective management of activities as the route to continuously improving the value received by customers. ABM utilizes cost information gathered through ABC.

Various analysis in Activity Based Management

The various types of analysis involved in ABM are as follows:

- (1) **Cost Driver Analysis:** The factors that cause activities to be performed need to be identified in order to manage activity costs. Cost driver analysis identifies the causal factors.
- (2) **Activity Analysis.**
 - (a) **Value-Added Activities (VA):** The value-added activities are those activities which are indispensable in order to complete the process. The customers are usually willing to pay (in some way) for these services. For example, polishing furniture by a manufacturer dealing in furniture is a value added activity.
 - (b) **Non-Value-Added Activities (NVA):** The NVA activity **represents work that is not valued by the external or internal customer.** NVA activities do not improve the quality or function of a product or service, but they can adversely affect costs and prices. Moving materials and machine set up for a production run are examples of NVA activities.
- (3) **Performance Analysis:** Performance analysis involves the **identification of appropriate measures to report the performance of activity centres** or other organisational units, consistent with each unit's goals and objectives.

Activity Based Management in Business

Activity Based Management can be used in the following ways

- (i) **Cost Reduction:** ABM helps the organisation to identify costs against activities and to find opportunities to streamline or reduce the costs or eliminate the entire activity, especially if there is no value added.
- (ii) **Business Process Re-engineering:** Business process re-engineering **involves examining business processes and making substantial changes to how organisation currently operates.** ABM is a powerful tool for measuring business performance, determining the cost of business output and is used as a means of identifying opportunities to improve process efficiency and effectiveness.

- (iii) **Benchmarking:** Benchmarking is a process of **comparing of ABC-derived activity costs of one segment of company with those of other segments**. It requires uniformity in the definition of activities and measurement of their costs.
- (iv) **Performance Measurement:** Many organisations are now focusing on activity performance as a means of facing competitors and managing costs by monitoring the efficiency and effectiveness of activities.

Area	Measure
Quality of purchased component	Zero defects
Quality of output	% yield
Customer awareness	Orders; number of complaints

11.3 Facilitate Activity Based Budgeting

Meaning of Activity Based Budgeting (ABB)

Activity based budgeting **analyse the resource input or cost for each activity**. It provides a framework for estimating the amount of resources required in accordance with the budgeted level of activity. Actual results can be compared with budgeted results to highlight both, in financial and non-financial terms, those activities with major discrepancies from budget for potential reduction in supply of resources. It is a planning and control system which seeks to support the objectives of continuous improvement. It means planning and controlling the expected activities of the organization to derive a cost-effective budget that meet forecast workload and agreed strategic goals. *ABB is the reversing of the ABC process to produce financial plans and budgets.*

Key Elements of ABB

The three key elements of activity based budgeting are as follows:-

- ◆ Type of work to be done
- ◆ Quantity of work to be done
- ◆ Cost of work to be done

Benefits of ABB

Few benefits of activity based budgeting are as follows:-

- (i) Activity Based Budgeting (ABB) can enhance accuracy of financial forecasts and increasing management understanding.
- (ii) When automated, ABB can rapidly and accurately produce financial plans and models based on varying levels of volume assumptions.
- (iii) ABB eliminates much of the needless rework created by traditional budgeting techniques.

ILLUSTRATION 2

MST Limited has collected the following data for its two activities. It calculates activity cost rates based on cost driver capacity.

Activity	Cost Driver	Capacity	Cost
Power	Kilowatt hours	50,000 kilowatt hours	₹ 2,00,000
Quality Inspections	Number of Inspections	10,000 Inspections	₹ 3,00,000

The company makes three products M, S and T. For the year ended March 31st, the following consumption of cost drivers was reported:

Product	Kilowatt hours	Quality Inspections
M	10,000	3,500
S	20,000	2,500
T	15,000	3,000

Required:

- (i) *COMPUTE the costs allocated to each product from each activity.*
- (ii) *CALCULATE the cost of unused capacity for each activity.*
- (iii) *DISCUSS the factors the management considers in choosing a capacity level to compute the budgeted fixed overhead cost rate.*

SOLUTION**(i) Statement of cost allocation to each product from each activity**

	Product			
	M (₹)	S (₹)	T (₹)	Total (₹)
Power (Refer to working note)	40,000 (10,000 kWh × ₹4)	80,000 (20,000 kWh × ₹4)	60,000 (15,000 kWh × ₹4)	1,80,000
Quality Inspections (Refer to working note)	1,05,000 (3,500 inspections × ₹30)	75,000 (2,500 inspections × ₹30)	90,000 (3,000 inspections × ₹30)	2,70,000

Working note**Rate per unit of cost driver:**

Power	(₹ 2,00,000 / 50,000 kWh)	₹ 4/kWh
Quality Inspection	(₹ 3,00,000 / 10,000 inspections)	₹ 30 per inspection

(ii) Computation of cost of unused capacity for each activity:

	(₹)
Power (₹ 2,00,000 – ₹ 1,80,000) or 5,000 × 4	20,000
Quality Inspections (₹ 3,00,000 – ₹ 2,70,000) or 1,000 × 30	30,000
Total cost of unused capacity	50,000

(iii) Factors management consider in choosing a capacity level to compute the budgeted fixed overhead cost rate:

- Effect on product costing & capacity management
- Effect on pricing decisions.
- Effect on performance evaluation
- Effect on financial statements
- Regulatory requirements.
- Difficulties in forecasting.

ILLUSTRATION 3

ABC Ltd. Manufactures two types of machinery equipment Y and Z and applies/absorbs overheads on the basis of direct-labour hours. The budgeted overheads and direct-labour hours for the month of December are ₹ 12,42,500 and 20,000 hours respectively. The information about Company's products is as follows:

	Equipment	Equipment
	Y	Z
Budgeted Production volume	2,500 units	3,125 units
Direct material cost	₹ 300 per unit	₹ 450 per unit
Direct labour cost		
Y : 3 hours @ ₹ 150 per hour		
Z : 4 hours @ ₹ 150 per hour	₹ 450	₹ 600

ABC Ltd.'s overheads of ₹ 12,42,500 can be identified with three major activities:

Order Processing (₹ 2,10,000), machine processing (₹ 8,75,000), and product inspection (₹ 1,57,500). These activities are driven by number of orders processed, machine hours worked, and inspection hours, respectively. The data relevant to these activities is as follows:

	Orders processed	Machine hours worked	Inspection hours
Y	350	23,000	4,000
Z	250	27,000	11,000
Total	600	50,000	15,000

Required:

- Assuming use of direct-labour hours to absorb/apply overheads to production, COMPUTE the unit manufacturing cost of the equipment Y and Z, if the budgeted manufacturing volume is attained.
- Assuming use of activity-based costing, COMPUTE the unit manufacturing costs of the equipment Y and Z, if the budgeted manufacturing volume is achieved.

- (iii) ABC Ltd.'s selling prices are based heavily on cost. By using direct-labour hours as an application base, CALCULATE the amount of cost distortion (under-costed or over-costed) for each equipment.

SOLUTION**(i) Overheads application base: Direct labour hours**

	Equipment	Equipment
	Y (₹)	Z (₹)
Direct material cost	300	450
Direct labour cost	450	600
Overheads*	186.38	248.50
	936.38	1,298.50

$$\text{*Pre-determined rate} = \frac{\text{Budgeted overheads}}{\text{Budgeted direct labour hours}} = \frac{\text{₹ 12,42,500}}{20,000 \text{ hours}} = \text{₹62.125}$$

(ii) Estimation of Cost-Driver rate

Activity	Overhead cost	Cost-driver level	Cost driver rate
	(₹)		(₹)
Order processing	2,10,000	600 Orders processed	350
Machine processing	8,75,000	50,000 Machine hours	17.50
Inspection	1,57,500	15,000 Inspection hours	10.50

	Equipment	Equipment
	Y (₹)	Z (₹)
Direct material cost	300	450
Direct labour cost	450	600
Prime Cost	750	1,050
Overhead Cost		
Order processing 350 : 250 or Rs 350 per order	1,22,500	87,500
Machine processing 23,000 : 27,000 or ₹ 17.5 per hour	4,02,500	4,72,500
Inspection 4,000 : 11,000	42,000	1,15,500
Total overhead cost	5,67,000	6,75,500
Per unit cost	Y (₹)	Z (₹)
5,67,000 / 2,500	226.80	₹ 216.16
6,75,500 / 3,125		
Unit manufacturing cost (Prime Cost + Overhead per unit)	₹ 976.80	₹ 1,266.16

(iii)

	Equipment	Equipment
	Y (₹)	Z (₹)
Unit manufacturing cost—using direct labour hours as an application base	936.38	1,298.50
Unit manufacturing cost—using activity based costing	976.80	1,266.16
Cost distortion	(-)40.42	+ 32.34

Low volume product Y is under-costed and high volume product Z is over costed using direct labour hours for overhead absorption.

ILLUSTRATION 4

'Humara - Apna' bank offers three products, viz., deposits, Loans and Credit Cards. The bank has selected 4 activities for a detailed budgeting exercise, following activity based costing methods.

The bank wants to know the product wise total cost per unit for the selected activities, so that prices may be fixed accordingly.

The following information is made available to formulate the budget:

Activity	Present Cost (₹)	Estimation for the budget period
ATM Services:		
(a) Machine Maintenance	4,00,000	All fixed, no change.
(b) Rents	2,00,000	Fully fixed, no change.
(c) Currency Replenishment Cost	1,00,000	Expected to double during budget period.
	7,00,000	(This activity is driven by no. of ATM transactions)
Computer Processing	5,00,000	Half this amount is fixed and no change is expected. The variable portion is expected to increase to three times the current level. (This activity is driven by the number of computer transactions)
Issuing Statements	18,00,000	Presently, 3 lakh statements are made. In the budget period, 5 lakh statements are expected. For every increase of one lakh statement, one lakh rupees is the budgeted increase. (This activity is driven by the number of statements)

Computer Inquiries	2,00,000	Estimated to increase by 80% during the budget period. (This activity is driven by telephone minutes)
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The activity drivers and their budgeted quantifies are given below:

Activity Drivers	Deposits	Loans	Credit Cards
No. of ATM Transactions	1,50,000	---	50,000
No. of Computer Processing Transactions	15,00,000	2,00,000	3,00,000
No. of Statements to be issued	3,50,000	50,000	1,00,000
Telephone Minutes	3,60,000	1,80,000	1,80,000

The bank budgets a volume of 58,600 deposit accounts, 13,000 loan accounts, and 14,000 Credit Card Accounts.

Required:

- CALCULATE the budgeted rate for each activity.
- PREPARE the budgeted cost statement activity wise.
- COMPUTE the budgeted product cost per account for each product using (i) and (ii) above.

SOLUTION

Statement Showing "Budgeted Cost per unit of the Product"

Activity	Activity Cost (Budgeted) (₹)	Activity Driver	No. of Units of Activity Driver (Budget)	Activity Rate (₹)	Deposits (₹)	Loans (₹)	Credit Cards (₹)
ATM Services	8,00,000	No. of ATM Transaction	2,00,000	4.00	6,00,000	---	2,00,000

Computer Processing	10,00,000	No. of Computer processing Transaction	20,00,000	0.50	7,50,000	1,00,000	1,50,000
Issuing Statements	20,00,000	No. of Statements	5,00,000	4.00	14,00,000	2,00,000	4,00,000
Customer Inquiries	3,60,000	Telephone Minutes	7,20,000	0.50	1,80,000	90,000	90,000
Budgeted Cost	41,60,000				29,30,000	3,90,000	8,40,000
Units of Product (as estimated in the budget period)					58,600	13,000	14,000
Budgeted Cost <i>per unit</i> of the product					(₹) 50	(₹) 30	(₹) 60

Working Note

Activity	Budgeted Cost (₹)	Remark
ATM Services:		
(a) Machine Maintenance	4,00,000	- All fixed, no change.
(b) Rents	2,00,000	- Fully fixed, no change.
(c) Currency Replenishment Cost	2,00,000	- Doubled during budget period.
Total	8,00,000	
Computer Processing	2,50,000	- ₹ 2,50,000 (half of ₹ 5,00,000) is fixed and no change is expected.
	7,50,000	- ₹ 2,50,000 (variable portion) is expected to increase to three times the current level.
Total	10,00,000	

Issuing Statements	18,00,000	- Existing. - 2 lakh statements are expected to be increased in budgeted period. For every increase of one lakh statement, one lakh rupees is the budgeted increase.
	2,00,000	
Total	20,00,000	
Computer Inquiries	3,60,000	- Estimated to increase by 80% during the budget period. (₹ 2,00,000 x 180%)
	3,60,000	
Total	3,60,000	

SUMMARY

- ♦ Activity based costing is an accounting methodology that assigns costs to activities rather than products or services. This enables resources & overhead costs to be more accurately assigned to products & services that consume them.
- ♦ Unit level activities, batch level activities, product level activities and facility level activities are the categories of activities that help to determine the type of activity cost driver required.
- ♦ ABC is very much useful to the organization with multiple products.
- ♦ The limitations of ABC are that, it is very costly and cannot be applied to all companies.
- ♦ The use of ABC as a costing tool to manage costs at activity level is known as Activity Based Cost Management (ABM). ABM is a discipline that focuses on the efficient and effective management of activities as the route to continuously improving the value received by customers. ABM utilizes cost information gathered through ABC.
- ♦ The value-added activities are those activities which are indispensable in order to complete the process.

- ◆ NVA activity represents work that is not valued by the external or internal customer. NVA activities do not improve the quality or function of a product or service, but they can adversely affect costs and prices.
- ◆ Activity-based budgeting is a process of planning and controlling the expected activities for the organisation to derive a cost-effective budget that meets forecast workload and agreed strategic goals.
- ◆ Key elements of ABB are type of work/activity to be performed, quantity of work/activity to be performed and cost of work/activity to be performed.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. A cost driver is:
 - (a) An item of production overheads
 - (b) A common cost which is shared over cost centres
 - (c) Any cost relating to transport
 - (d) An activity which generates costs
2. In activity based costing, costs are accumulated by activity using:
 - (a) Cost drivers
 - (b) Cost objects
 - (c) Cost pools
 - (d) Cost benefit analysis
3. A cost driver:
 - (a) Is a force behind the overhead cost
 - (b) Is an allocation base
 - (c) Is a transaction that is a significant determinant of cost
 - (d) All of the above

4. Which of the following is not a correct match:

Activity	Cost Driver
(a) Production Scheduling	Number of Production runs
(b) Despatching	Number of dispatch orders
(c) Goods receiving	Goods received orders
(d) Inspection	Machine hours

5. Transactions undertaken by support department personnel are the appropriate cost drivers. Find the one which is **not** appropriate:

- (a) The number of purchase, supplies and customers' orders drives the cost associated with new material inventory, work-in-progress and finished goods inventory
- (b) The number of production runs undertaken drives production scheduling, inspection and material handling
- (c) The quality of raw material issued drives the cost of receiving department costs
- (d) The number of packing orders drives the packing costs

6. Steps in ABC include:

- (a) Identification of activities and their respective costs
- (b) Identification of cost driver of each activity and computation of an allocation rate per activity
- (c) Allocation of overhead cost to products/ services based on the activities involved
- (d) All of the above

7. Which of the following is not a benefit of ABC?

- (a) Accurate cost allocation
- (b) Improved decision making
- (c) Better control on activity and costs
- (d) Reduction of prime cost

8. *The steps involved for installation of ABC in a manufacturing company include the following except:*
- (a) *Borrowing fund*
 - (b) *Feasibility study*
 - (c) *Building up necessary IT infrastructure and training of line employees*
 - (d) *Strategy and value chain analysis*
9. *Which of the following statements are true: (1) Activity based Management involves activity analysis and performance measurement. (2) Activity based costing serves as a major source of information in ABM.*
- (a) *(1) True; (2) False*
 - (b) *(1) True; (2) True*
 - (c) *(1) False; (2) True*
 - (d) *(1) False; (2) False*
10. *The key elements of activity based budgeting are:*
- (a) *Type of activity to be performed*
 - (b) *Quantity of activity to be performed*
 - (c) *Cost of activity to be performed*
 - (d) *All of the above*

Theoretical Questions

1. *DEFINE the following terms:*
 - (i) *Cost driver*
 - (ii) *Activity cost pool*
2. *EXPLAIN in brief the problems of traditional costing where overhead costs are allocated based on volume.*
3. *STATE what is Activity based costing. How are product costs determined in ABC?*

4. A manufacturing company in India wants to replace its traditional costing system by ABC. It produces a number of products, each having complex production process of different degree. SUGGEST various requirements for installing activity based costing.
5. DESCRIBE various levels of activities under ABC.
6. STATE what are the benefits of ABC.
7. STATE what are the limitations of ABC.
8. STATE what are the practical applications of ABC.
9. STATE what is Activity based Management. How does ABC help ABM?
10. DEFINE Activity based Budgeting. STATE what are its key elements.

Practical Problems

1. Woolmark Ltd. manufactures three types of products namely P, Q and R. The data relating to a period are as under:

Particulars	P	Q	R
Machine hours per unit	10	18	14
Direct Labour hours per unit	4	12	8
Direct Material per unit (₹)	90	80	120
Production (units)	3,000	5,000	20,000

Currently the company uses traditional costing method and absorbs all production overheads on the basis of machine hours. The machine hour rate of overheads is ₹6 per hour. Direct labour hour rate is ₹20 per hour.

The company proposes to use activity based costing system and the activity analysis is as under:

Particulars	P	Q	R
Batch size (units)	150	500	1,000
Number of purchase orders per batch	3	10	8
Number of inspections per batch	5	4	3

The total production overheads are analysed as under:

Machine set up costs.....	20%
Machine operation costs.....	30%
Inspection costs.....	40%
Material procurement related costs.....	10%

Required

- (i) CALCULATE the cost per unit of each product using traditional method of absorbing all production overheads on the basis of machine hours.
 - (ii) CALCULATE the cost per unit of each product using activity based costing principles.
2. RST Limited specializes in the distribution of pharmaceutical products. It buys from the pharmaceutical companies and resells to each of the three different markets.
- (i) General Supermarket Chains
 - (ii) Drugstore Chains
 - (iii) Chemist Shops

The following data for the month of April in respect of RST Limited has been reported:

	General Supermarket Chains (₹)	Drugstore Chains (₹)	Chemist Shops (₹)
Average revenue per delivery	84,975	28,875	5,445
Average cost of goods sold per delivery	82,500	27,500	4,950
Number of deliveries	330	825	2,750

In the past, RST Limited has used gross margin percentage to evaluate the relative profitability of its distribution channels.

The company plans to use activity-based costing for analysing the profitability of its distribution channels.

The Activity analysis of RST Limited is as under:

Activity Area	Cost Driver
Customer purchase order processing	Purchase orders by customers
Line-item ordering	Line-items per purchase order
Store delivery	Store deliveries
Cartons dispatched to stores	Cartons dispatched to a store per delivery
Shelf-stocking at customer store	Hours of shelf-stocking

The April month's operating costs (other than cost of goods sold) of RST Limited are ₹ 8,27,970. These operating costs are assigned to five activity areas. The cost in each area and the quantity of the cost allocation basis used in that area for the month of April are as follows:

Activity Area	Total costs (₹)	Total Units of Cost Allocation Base
Customer purchase order processing	2,20,000	5,500 orders
Line-item ordering	1,75,560	58,520 line items
Store delivery	1,95,250	3,905 store deliveries
Cartons dispatched to store	2,09,000	2,09,000 cartons
Shelf-stocking at customer store	28,160	1,760 hours

Other data for the month of April include the following:

	General Supermarket Chains	Drugstore Chains	Chemist Shops
Total number of orders	385	990	4,125
Average number of line items per order	14	12	10
Total number of store deliveries	330	825	2,750
Average number of cartons shipped per store delivery	300	80	16
Average number of hours of shelf-stocking per store delivery	3	0.6	0.1

Required:

- (i) COMPUTE gross-margin percentage for each of its three distribution channels and compute RST Limited's operating income.
 - (ii) COMPUTE the rate per unit of the cost-allocation base for each of the five activity areas.
 - (iii) COMPUTE the operating income of each distribution channel using the activity-based costing information. Comment on the results. What new insights are available with the activity-based cost information?
 - (iv) DESCRIBE four challenges one would face in assigning the total operating costs of ₹ 8,27,970 to five activity areas.
3. Family Store wants information about the profitability of individual product lines: Soft drinks, Fresh produce and Packaged food. Family store provides the following data for the current year for each product line:

	Soft drinks	Fresh produce	Packaged food
Revenues	₹ 39,67,500	₹ 1,05,03,000	₹ 60,49,500
Cost of goods sold	₹ 30,00,000	₹ 75,00,000	₹ 45,00,000
Cost of bottles returned	₹ 60,000	₹ 0	₹ 0

<i>Number of purchase orders placed</i>	360	840	360
<i>Number of deliveries received</i>	300	2,190	660
<i>Hours of shelf-stocking time</i>	540	5,400	2,700
<i>Items sold</i>	1,26,000	11,04,000	3,06,000

Family store also provides the following information for the current year:

Activity	Description of activity	Total Cost	Cost-allocation base
<i>Bottles returns</i>	<i>Returning of empty bottles</i>	₹ 60,000	<i>Direct tracing to soft drink line</i>
<i>Ordering</i>	<i>Placing of orders for purchases</i>	₹ 7,80,000	<i>1,560 purchase orders</i>
<i>Delivery</i>	<i>Physical delivery and receipt of goods</i>	₹ 12,60,000	<i>3,150 deliveries</i>
<i>Shelf stocking</i>	<i>Stocking of goods on store shelves and on-going restocking</i>	₹ 8,64,000	<i>8,640 hours of shelf-stocking time</i>
<i>Customer Support</i>	<i>Assistance provided to customers including check-out</i>	₹ 15,36,000	<i>15,36,000 items sold</i>

Required:

- (i) *Family store currently allocates support cost (all cost other than cost of goods sold) to product lines on the basis of cost of goods sold of each product line. CALCULATE the operating income and operating income as a % of revenues for each product line.*
- (ii) *If Family Store allocates support costs (all costs other than cost of goods sold) to product lines using an activity-based costing system, CALCULATE the operating income and operating income as a % of revenues for each product line.*

4. Alpha Limited has decided to analyse the profitability of its five new customers. It buys bottled water at ₹ 90 per case and sells to retail customers at a list price of ₹ 108 per case. The data pertaining to five customers are:

	Customers				
	A	B	C	D	E
<i>Cases sold</i>	4,680	19,688	1,36,800	71,550	8,775
<i>Listed Selling Price</i>	₹ 108	₹ 108	₹ 108	₹ 108	₹ 108
<i>Actual Selling Price</i>	₹ 108	₹ 106.20	₹ 99	₹ 104.40	₹ 97.20
<i>Number of Purchase orders</i>	15	25	30	25	30
<i>Number of Customer visits</i>	2	3	6	2	3
<i>Number of deliveries</i>	10	30	60	40	20
<i>Kilometers travelled per delivery</i>	20	6	5	10	30
<i>Number of expedited deliveries</i>	0	0	0	0	1

Its five activities and their cost drivers are:

Activity	Cost Driver Rate
<i>Order taking</i>	₹ 750 per purchase order
<i>Customer visits</i>	₹ 600 per customer visit
<i>Deliveries</i>	₹ 5.75 per delivery Km travelled
<i>Product handling</i>	₹ 3.75 per case sold
<i>Expedited deliveries</i>	₹ 2,250 per expedited delivery

Required:

- (i) COMPUTE the customer-level operating income of each of five retail customers now being examined (A, B, C, D and E). Comment on the results.
 - (ii) STATE what insights are gained by reporting both the list selling price and the actual selling price for each customer.
5. BABYSOFT is a global brand created by Bio-organic Ltd. The company manufactures three ranges of beauty soaps i.e. BABYSOFT- Gold, BABYSOFT- Pearl, and BABYSOFT- Diamond. The budgeted costs and production for the month of December are as follows:

	BABYSOFT- Gold		BABYSOFT- Pearl		BABYSOFT- Diamond	
Production of soaps (Units)	4,000		3,000		2,000	
Resources per Unit:	Qty	Rate	Qty	Rate	Qty	Rate
Essential Oils	60 ml	₹ 200 / 100 ml	55 ml	₹ 300 / 100 ml	65 ml	₹ 300 / 100 ml
Cocoa Butter	20 g	₹ 200 / 100 g	20 g	₹ 200 / 100 g	20 g	₹ 200 / 100 g
Filtered Water	30 ml	₹ 15 / 100 ml	30 ml	₹ 15 / 100 ml	30 ml	₹ 15 / 100 ml
Chemicals	10 g	₹ 30 / 100 g	12 g	₹ 50 / 100 g	15 g	₹ 60 / 100 g
Direct Labour	30 minutes	₹ 10 / hour	40 minutes	₹ 10 / hour	60 minutes	₹ 10 / hour

Bio-organic Ltd. followed an Absorption Costing System and absorbed its production overheads, to its products using direct labour hour rate, which were budgeted at ₹ 1,98,000.

Now, Bio-organic Ltd. is considering adopting an Activity Based Costing system. For this, additional information regarding budgeted overheads and their cost drivers is provided below:

Particulars	(₹)	Cost drivers
Forklifting cost	58,000	Weight of material lifted
Supervising cost	60,000	Direct labour hours
Utilities	80,000	Number of Machine operations

The number of machine operations per unit of production are 5, 5, and 6 for BABYSOFT- Gold, BABYSOFT- Pearl, and BABYSOFT- Diamond respectively.

(Consider (i) Mass of 1 litre of Essential Oils and Filtered Water equivalent to 0.8 kg and 1 kg respectively (ii) Mass of output produced is equivalent to the mass of input materials taken together.)

You are requested to:

- (i) PREPARE a statement showing the unit costs and total costs of each product using the absorption costing method.
 - (ii) PREPARE a statement showing the product costs of each product using the ABC approach.
 - (iii) STATE what are the reasons for the different product costs under the two approaches.
6. Edward Ltd. manufactures weighing machines of standard size and sells its products to two industrial customers namely MT Ltd. and KG Ltd. and to a dealer MG Bros. having shops in different cities. The maximum retail price per unit of weighing machine is ₹ 11,000 and per unit average cost of production is ₹ 5,500 (40% is general fixed overhead cost).

The Finance Officer has been asked to undertake a customer profitability analysis and calculate and compare the profit margin per customer (before deducting general fixed overhead) to know about the real customer profitability.

Following are the additional overhead information:

Delivery costs	₹ 200 per kilometer
Emergency delivery cost (in addition to delivery cost)	₹ 21,000 per delivery
Order processing cost	₹ 6,000 per order

Specific discount and sales commission	As per negotiation
Product Advertisement cost	Actual cost

The following data are available for each customer.

	MT Ltd.	KG Ltd.	MG Bros.
Sales (in units)	2,000	1,000	800
Total delivery kilometer travelled	1,000	800	900
No. of emergency delivery	2	1	0
No. of orders processed	4	2	8
Specific Discount (percentage of sales revenue)	25%	20%	15%
Sales commission (percentage of sales revenue)	15%	10%	5%
Advertisement costs (₹)	8,75,000	6,15,000	4,30,000

You are required to ANALYSE the profitability for each customer, WHICH customer is the most profitable.

7. The profit margin of BABY Hairclips Company were over 20% of sales producing BROWN and BLACK hairclips.

During the last year, GREEN hairclips had been introduced at 10% premium in selling price after the introduction of YELLOW hairclips earlier five years back at 10/3% premium. However, the manager of the company is disheartened with the sales figure for the current financial year as follows:

Traditional Income Statement (in ₹)

	Brown	Black	Yellow	Green	Total
Sales	1,50,00,000	1,20,00,000	27,90,000	3,30,000	3,01,20,000
Material Costs	50,00,000	40,00,000	9,36,000	1,10,000	1,00,46,000
Direct Labour	20,00,000	16,00,000	3,60,000	40,000	40,00,000
Overhead (3 times of direct)	60,00,000	48,00,000	10,80,000	1,20,000	1,20,00,000

labour)					
Total Operating Income	20,00,000	16,00,000	4,14,000	60,000	40,74,000
Return on Sales (in %)	13.3%	13.3%	14.8%	18.2%	13.5%

It is a known fact that customers are ready to pay premium amount for YELLOW and GREEN hairclips for their attractiveness; and the percentage returns are also high on new products.

At present, all of the Plant's indirect expenses are allocated to the products at 3 times of the direct labour expenses. However, the manager is interested in allocating indirect expenses on the basis of activity cost to reveal real earner.

He provides support expenses category-wise as follows:

Support Expenses	(₹)
Indirect Labour	40,00,000
Labour Incentives	32,00,000
Computer Systems	20,00,000
Machinery depreciation	16,00,000
Machine maintenance	8,00,000
Energy for machinery	<u>4,00,000</u>
Total	1,20,00,000

*He provides following **additional information** for accomplishment of his interest:*

Incentives to be allocated @ 40% of labour expenses (both direct and indirect).

Indirect labours are involved mainly in three activities. About half of indirect labour is involved in handling production runs. Another 40% is required just for the physical changeover from one color hairclip to another because YELLOW hairclips require substantial labour for preparing the machine as compared to other colour hairclips. Remaining 10% of the time is spend for maintaining records of the products in four parts.

Another amount spent on computer system of ` 20,00,000 is for maintenance of documents relating to production runs and record keeping of the four products. In aggregate, approx.. 80% of the amount expend is involved in the production

run activity and approx. 20% is used to keep records of the products in four parts.

Other overhead expenses i.e. machinery depreciation, machine maintenance and energy for machinery are incurred to supply machine capacity to produce all the hairclips (practical capability of 20,000 hours).

Activity Cost Drivers:

Particulars	Brown	Black	Yellow	Green	Total
Sales Volume (units)	1,00,000	80,000	18,000	2,000	2,00,000
Selling Price (₹)	150	150	155	165	
Material cost (₹)	50	50	52	55	
Machine hours per unit (Hrs)	0.10	0.10	0.10	0.10	20,000
Production runs	100	100	76	24	300
Setup time per run (Hrs)	4	1	6	4	

You are required to –

- CALCULATE operating income and operating income as per percentage of sales using activity-based costing system.
- STATE the reasons for different operating income under traditional income system and activity-based costing system.

Case Scenarios

- The sales department of A Limited is analysing the customer profitability for its Product Z. It has decided to analyse the profitability of its five new customers using activity-based costing method. It buys Product Z at ₹ 5,400 per unit and sells to retail customers at a listed price of ₹ 6,480 per unit. The data pertaining to five customers are:

	Customers				
	A	B	C	D	E
Units sold	4,500	6,000	9,500	7,500	12,750
Listed Selling Price	₹6,480	₹6,480	₹6,480	₹6,480	₹6,480
Actual Selling Price	₹6,480	₹6,372	₹5,940	₹6,264	₹5,832

Number of Purchase orders	15	25	30	25	30
Number of Customer visits	2	3	6	2	3
Number of deliveries	10	30	60	40	20
Kilometers travelled per delivery	20	6	5	10	30
Number of expedited deliveries	0	0	0	0	1

After a detailed analysis and computation, the following activities has been identified and respective cost has been calculated:

Activity	Cost Driver Rate
Order taking	₹4,500 per purchase order
Customer visits	₹3,600 per customer visit
Deliveries	₹7.50 per delivery Km travelled
Product handling	₹22.50 per case sold
Expedited deliveries	₹13,500 per expedited delivery

You have been assigned the following task of computing different cost information for managerial decision making:

(i) How much cost on customer visit is incurred on customer E?

- (a) ₹7,200
- (b) ₹10,800
- (c) ₹21,600
- (d) ₹3,600

(ii) What is the cost of goods sold for customer D?

- (a) ₹2,43,00,000
- (b) ₹3,24,00,000
- (c) ₹5,13,00,000
- (d) ₹4,05,00,000

- (iii) *How much is the cost of expediting delivery for customer A?*
- (a) ₹ 13,500
 - (b) ₹ 27,000
 - (c) ₹ 40,500
 - (d) ₹ 0
- (iv) *Compute the customer-level operating income of each of customers A.*
- (a) ₹ 55,72,350
 - (b) ₹ 46,82,550
 - (c) ₹ 47,57,400
 - (d) ₹ 50,57,325
- (v) *Compute the customer-level operating income of each of five retail customers D and E.*
- (a) ₹ 46,82,550 & 50,65,720
 - (b) ₹ 55,72,350 & 46,85,500
 - (c) ₹ 47,57,400 & 55,72,350
 - (d) ₹ 61,88,550 & 50,57,325
2. *With the rise in carbon dioxide, a greenhouse gas, release in the environment, when fossil fuels are burned, Earth's natural greenhouse effect is becoming too weak causing global warming.*

To contribute towards global environment for the betterment, various cars and scooters manufacturing companies are shifting their production towards electric vehicles (EVs) manufacturing. Companies are heavily investing in research, development and production of EVs.

Olay Ltd. is also one the companies belonging to scooter manufacturing industry. Watching its rivalries shifting their production to EVs, the management of Olay Ltd. decided to take the advantage of this open opportunity.

It had been only 4 years since the company started its production of EVs, but last year, the management of the company also decided to expand its product line to 3 variants of the scooter, viz., Olay EV Max, Olay EV Ultra and Olay EV Pro.

The following information is provided for the current year from the books of Olay Ltd.:

	Olay EV Max	Olay EV Ultra	Olay EV Pro
Average revenue per unit (₹)	84,975	1,15,500	2,17,800
Average cost of goods sold per unit (₹)	82,500	1,10,000	1,98,000

Last year, when the company initially expanded its product line, the sales were not much noticeable comparative to its earlier category of scooters. The company could only sold 528, 330 and 110 units of Olay EV Max, Olay EV Ultra and Olay EV Pro respectively against the order received of 616, 396 and 165 units respectively. However, with the increasing awareness about the EVs, more people started buying EVs and, during the current year, the company's order and sales jumped to five times the last year.

For earlier years, Olay Ltd. used gross margin percentage method to evaluate the relative profitability for all of its EVs.

However, from current year, company plans to use activity based costing for analysing the profitability.

The Activity analysis of Olay Ltd. is as under:

Activity Area	Cost-allocation base
Customer purchase order processing	Purchase orders by customers
Line-item ordering	Line-items per purchase order
Store delivery	Unit sold
Cartons dispatched to stores	Cartons dispatched to a store per Unit
Shelf-stocking at customer store	Hours of shelf-stocking

All the support costs for the current year amounts to ₹ 66,23,760. These support costs are assigned to all the activity areas. The cost in each area and the quantity of the cost allocation basis used in that area are as follows:

Activity Area	Total costs (₹)	Total Units of Cost- allocation base
Line-item ordering	14,04,480	66,110 line items
Cartons dispatched to store	16,72,000	3,39,240 cartons
Shelf-stocking at customer store	2,25,280	2,904 hours

The Customer purchase order processing costs ₹ 17,60,000 along with the store delivery cost of ₹ 15,62,000.

Some of the other information is also provided below:

	Olay EV Max	Olay EV Ultra	Olay EV Pro
Average number of line items per order	10	12	14
Average number of cartons shipped per store unit	16	80	300
Average number of hours of shelf-stocking per store delivery	0.1	0.6	3

The company wants you to **FIGURE OUT** the following to ascertain which of the product line is more profitable:

- (i) For the current year, how much is the order received and the units sold for Olay EV Max, Olay EV Ultra and Olay EV Pro respectively?
 - (a) Order received- 616, 396 and 165 units; sold- 528, 330 and 110 units of Olay EV Max, Olay EV Ultra and Olay EV Pro respectively.
 - (b) Order received- 3,696, 2,376 and 990 units; sold- 3,168, 1,980 and 660 units of Olay EV Max, Olay EV Ultra and Olay EV Pro respectively.
 - (c) Order received- 528, 330 and 110 units; sold- 616, 396 and 165 units of Olay EV Max, Olay EV Ultra and Olay EV Pro respectively.
 - (d) Order received- 3,080, 1,980 and 825 units; sold- 2,640, 1,650 and 550 units of Olay EV Max, Olay EV Ultra and Olay EV Pro respectively.
- (ii) The total gross-margin percentage and the operating income percentage, for the current year would be:
 - (a) Gross-margin - 3.72% and Operating income - 4.96%
 - (b) Gross-margin - 4.96% and Operating income - 3.72%
 - (c) Gross-margin - 4.96% and Operating income - 4.96%
 - (d) Gross-margin - 3.72% and Operating income - 3.72%

- (iii) The cost driver rate relating to all the five activity areas would be:
- (a) Customer purchase order processing- ₹ 363.64 per order, Line item ordering- ₹ 21.24 per line item order, Store delivery- ₹ 265.42 per unit sold, Cartons dispatched- ₹ 4.93 per dispatch and Shelf-stocking at customer store- ₹ 77.58 per hour.
 - (b) Customer purchase order processing- ₹ 299.07 per order, Line item ordering- ₹ 21.24 per line item order, Store delivery- ₹ 322.73 per unit sold, Cartons dispatched- ₹ 4.93 per dispatch and Shelf-stocking at customer store- ₹ 77.58 per hour.
 - (c) Customer purchase order processing- ₹ 299.07 per order, Line item ordering- ₹ 77.58 per line item order, Store delivery- ₹ 322.73 per unit sold, Cartons dispatched- ₹ 4.93 per dispatch and Shelf-stocking at customer store- ₹ 21.24 per hour.
 - (d) Customer purchase order processing- ₹ 322.73 per order, Line item ordering- ₹ 21.24 per line item order, Store delivery- ₹ 299.07 per unit sold, Cartons dispatched- ₹ 4.93 per dispatch and Shelf-stocking at customer store- ₹ 77.58 per hour.
- (iv) The operating cost of the individual product line, as per the method proposed for the current year w.r.t. profitability analysis, would be:
- (a) Olay EV Max- ₹ 16,11,013, Olay EV Ultra- ₹ 23,56,890 and Olay EV Pro- ₹ 26,56,059
 - (b) Olay EV Max- ₹ 23,56,890, Olay EV Ultra- ₹ 26,56,059 and Olay EV Pro- ₹ 16,11,013
 - (c) Olay EV Max- ₹ 26,56,059, Olay EV Ultra- ₹ 16,11,013 and Olay EV Pro- ₹ 23,56,890
 - (d) Olay EV Max- ₹ 26,56,059, Olay EV Ultra- ₹ 23,56,890 and Olay EV Pro- ₹ 16,11,013
- (v) Operating income as a percentage of revenues of each product line, namely Olay EV Max, Olay EV Ultra and Olay EV Pro, when all the support costs are allocated using an activity-based costing system would be:
- (a) Olay EV Max- 1.73%, Olay EV Ultra- 3.53% and Olay EV Pro- 7.75%

- (b) Olay EV Max- 1.18%, Olay EV Ultra- 1.24% and Olay EV Pro- 1.34%
- (c) Olay EV Max- 2.91%, Olay EV Ultra- 4.76% and Olay EV Pro- 9.09%
- (d) Olay EV Max- 1.78%, Olay EV Ultra- 3.70% and Olay EV Pro- 8.52%

ANSWERS

Answers to the MCQs

1.	(d)	2.	(c)	3.	(d)	4.	(d)	5.	(c)	6.	(d)
7.	(d)	8.	(a)	9.	(b)	10.	(d)				

Answers to the Theoretical Questions

1. Please refer paragraph 3
2. Please refer paragraph 1
3. Please refer paragraph 2, 5 and 7
4. Please refer paragraph 10
5. Please refer paragraph 6
6. Please refer paragraph 8
7. Please refer paragraph 9
8. Please refer paragraph 11
9. Please refer paragraph 11.2
10. Please refer paragraph 11.3

Answers to the Practical Problems

1. (i) Statement Showing "Cost per unit - Traditional Method"

Particulars of Costs	P (₹)	Q (₹)	R (₹)
Direct Materials	90	80	120
Direct Labour [(4, 12, 8 hours) × ₹ 20]	80	240	160
Production Overheads [(10, 18, 14 hours) × ₹ 6]	60	108	84
Cost per unit	230	428	364

(ii) Statement Showing "Cost per unit - Activity Based Costing"

Products	P	Q	R
Production (units)	3,000	5,000	20,000
	(₹)	(₹)	(₹)
Direct Materials (90, 80, 120)	2,70,000	4,00,000	24,00,000
Direct Labour (80, 240, 160)	2,40,000	12,00,000	32,00,000
Machine Related Costs @ ₹ 1.80 per hour (30,000, 90,000, 2,80,000)	54,000	1,62,000	5,04,000
Setup Costs @ ₹ 9,600 per setup (20, 10, 20)	1,92,000	96,000	1,92,000
Inspection Costs @ ₹ 4,800 per inspection (100, 40, 60)	4,80,000	1,92,000	2,88,000
Purchase Related Costs @ ₹ 750 per purchase (60, 100, 160)	45,000	75,000	1,20,000
Total Costs	12,81,000	21,25,000	67,04,000
Cost per unit (Total Cost ÷ Units)	427.00	425.00	335.20

Workings

Number of Batches, Purchase Orders, and Inspections-

	Particulars	P	Q	R	Total
A.	Production (units)	3,000	5,000	20,000	
B.	Batch Size (units)	150	500	1,000	
C.	Number of Batches ($A \div B$)	20	10	20	50
D.	Number of Purchase Order <i>per batch</i>	3	10	8	
E.	Total Purchase Orders [$C \times D$]	60	100	160	320
F.	Number of Inspections <i>per batch</i>	5	4	3	
G.	Total Inspections [$C \times F$]	100	40	60	200

Total Machine Hours-

	Particulars	P	Q	R
A.	Machine Hours <i>per unit</i>	10	18	14
B.	Production (units)	3,000	5,000	20,000
C.	Total Machine Hours [$A \times B$]	30,000	90,000	2,80,000

Total Machine Hours = 4,00,000

Total Production Overheads-

= 4,00,000 hrs. $\times$ ₹ 6 = ₹ 24,00,000

Cost Driver Rates-

Cost Pool	%	Overheads (₹)	Cost Driver Basis	Cost Driver (Units)	Cost Driver Rate (₹)
Setup	20%	4,80,000	Number of batches	50	9,600 per Setup
Inspection	40%	9,60,000	Number of inspections	200	4,800 per Inspection
Purchases	10%	2,40,000	Number of	320	750 per

			purchases		Purchase
Machine Operation	30%	7,20,000	Machine Hours	4,00,000	1.80 per Machine Hour

2. (i) RST Limited's

Statement of operating income and gross margin percentage for each of its three distribution channel

Particulars	General Super Market Chains	Drugstore Chains	Chemist Shops	Total
Revenues: (₹)	2,80,41,750 (330 × ₹ 84,975)	2,38,21,875 (825 × ₹ 28,875)	1,49,73,750 (2,750 × ₹ 5,445)	6,68,37,375
Less: Cost of goods sold: (₹)	2,72,25,000 (330 × ₹ 82,500)	2,26,87,500 (825 × ₹ 27,500)	1,36,12,500 (2,750 × ₹ 4,950)	635,25,000
Gross Margin: (₹)	8,16,750	11,34,375	13,61,250	33,12,375
Less: Other operating costs: (₹)				8,27,970
Operating income: (₹)				24,84,405
Gross Margin	2.91%	4.76 %	9.09%	4.96%
Operating income %				3.72

(ii) Computation of rate per unit of the cost allocation base for each of the five activity areas for the month of April

	(₹)
Customer purchase order processing (₹ 2,20,000/ 5,500 orders)	40 per order

Line item ordering (₹ 1,75,560/ 58,520 line items)	3 per line item order
Store delivery (₹ 1,95,250/ 3,905 store deliveries)	50 per delivery
Cartons dispatched (₹ 2,09,000/ 2,09,000 dispatches)	1 per dispatch
Shelf-stocking at customer store (₹) (₹ 28,160/ 1,760 hours)	16 Per hour

(iii) **Operating Income Statement of each distribution channel
in April (Using the Activity based Costing information)**

	General Super Market Chains	Drugstore Chains	Chemist Shops
Gross margin (₹) : (A) (Refer to (i) part of the answer)	8,16,750	11,34,375	13,61,250
Operating cost (₹): (B) (Refer to working note)	1,62,910	1,90,410	4,74,650
Operating income (₹): (A–B)	6,53,840	9,43,965	8,86,600
Operating income (in %) (Operating income/ Revenue) × 100	2.33	3.96	5.92

Comments and new insights: The activity-based cost information highlights, how the 'Chemist Shops' uses a larger amount of RST Ltd.'s resources per revenue than do the other two distribution channels. Ratio of operating costs to revenues, across these markets is:

General supermarket chains (₹ 1,62,910/ ₹ 2,80,41,750) × 100	0.58%
Drug store chains (₹ 1,90,410/ ₹ 2,38,21,875) × 100	0.80%

Chemist shops (₹ 4,74,650/ ₹ 1,49,73,750) × 100	3.17%
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Working note:**Computation of operating cost of each distribution channel:**

	General Super Market Chains (₹)	Drugstore Chains (₹)	Chemist Shops (₹)
Customer purchase order processing	15,400 (₹ 40 × 385 orders)	39,600 (₹ 40 × 990 orders)	1,65,000 (₹ 40 × 4125 orders)
Line item ordering	16,170 (₹ 3 × 14 × 385)	35,640 (₹ 3 × 12 × 990)	1,23,750 (₹ 3 × 10 × 4125)
Store delivery	16,500 (₹ 50 × 330 deliveries)	41,250 (₹ 50 × 825 deliveries)	1,37,500 (₹ 50 × 2750 deliveries)
Cartons dispatched	99,000 (₹ 1 × 300 cartons × 300 deliveries)	66,000 (₹ 1 × 80 cartons × 825 deliveries)	44,000 (₹ 1 × 16 cartons × 2,750 deliveries)
Shelf stocking	15,840 (₹ 16 × 330 deliveries × 3 Av. hrs.)	7,920 (₹ 16 × 825 deliveries × 0.6 Av. hrs)	4,400 (₹ 16 × 2,750 deliveries × 0.1 Av. hrs)
Operating cost	1,62,910	1,90,410	4,74,650

(iv) Challenges faced in assigning total operating cost of ₹ 8,27,970:

- Choosing an appropriate cost driver for activity area.
- Developing a reliable data base for the chosen cost driver.

- Deciding, how to handle costs that may be common across several activities.
- Choice of the time period to compute cost rates per cost driver.
- Behavioural factors

3. Working notes:

1. Total support cost:

	(₹)
Bottles returns	60,000
Ordering	7,80,000
Delivery	12,60,000
Shelf stocking	8,64,000
Customer support	15,36,000
Total support cost	45,00,000

2. Percentage of support cost to cost of goods sold (COGS):

$$= \frac{\text{Total support cost}}{\text{Total cost of goods sold}} \times 100$$

$$= \frac{₹ 45,00,000}{₹ 1,50,00,000} \times 100 = 30\%$$

3. Cost for each activity cost driver:

Activity (1)	Total cost (₹) (2)	Cost allocation base (3)	Cost driver rate (4)=[(2)÷(3)]
Ordering	7,80,000	1,560 purchase orders	₹ 500 per purchase order
Delivery	12,60,000	3,150 deliveries	₹ 400 per delivery
Shelf-stocking	8,64,000	8,640 hours	₹ 100 per stocking hour

Customer support	15,36,000	15,36,000 items sold	₹ 1 per item sold
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(i) **Statement of Operating income and Operating income as a percentage of revenues for each product line**

(When support costs are allocated to product lines on the basis of cost of goods sold of each product)

	Soft Drinks (₹)	Fresh Produce (₹)	Packaged Foods (₹)	Total (₹)
Revenues: (A)	39,67,500	1,05,03,000	60,49,500	2,05,20,000
Cost of Goods sold (COGS): (B)	30,00,000	75,00,000	45,00,000	1,50,00,000
Support cost (30% of COGS): (C) (Refer working notes)	9,00,000	22,50,000	13,50,000	45,00,000
Total cost: (D) = {(B) + (C)}	39,00,000	97,50,000	58,50,000	1,95,00,000
Operating income: E = {(A) - (D)}	67,500	7,53,000	1,99,500	10,20,000
Operating income as a percentage of revenues: (E/A) × 100)	1.70%	7.17%	3.30%	4.97%

(ii) **Statement of Operating income and Operating income as a percentage of revenues for each product line**

(When support costs are allocated to product lines using an activity-based costing system)

	Soft drinks (₹)	Fresh Produce (₹)	Packaged Food (₹)	Total (₹)
Revenues: (A)	39,67,500	1,05,03,000	60,49,500	2,05,20,000
Cost & Goods sold	30,00,000	75,00,000	45,00,000	1,50,00,000
Bottle return costs	60,000	0	0	60,000

Ordering cost* (360:840:360)	1,80,000	4,20,000	1,80,000	7,80,000
Delivery cost* (300:2190:660)	1,20,000	8,76,000	2,64,000	12,60,000
Shelf stocking cost* (540:5400:2700)	54,000	5,40,000	2,70,000	8,64,000
Customer Support cost* (1,26,000:11,04,000:3,06,000)	1,26,000	11,04,000	3,06,000	15,36,000
Total cost: (B)	35,40,000	1,04,40,000	55,20,000	1,95,00,000
Operating income C: {(A) - (B)}	4,27,500	63,000	5,29,500	10,20,000
Operating income as a % of revenues	10.78%	0.60%	8.75%	4.97%

* Refer to working note 3

4. Working note:

Computation of revenues (at listed price), discount, cost of goods sold and customer level operating activities costs:

	Customers				
	A	B	C	D	E
Cases sold: (a)	4,680	19,688	1,36,800	71,550	8,775
Revenues (at listed price) (₹): (b) {(a) × ₹ 108}	5,05,440	21,26,304	1,47,74,400	77,27,400	9,47,700
Discount (₹): (c) {(a) × Discount per case}	-	35,438 (19,688 cases × ₹ 1.80)	12,31,200 (1,36,800 cases × ₹ 9)	2,57,580 (71,550 cases × ₹ 3.60)	94,770 (8,775 cases × ₹ 10.80)
Cost of goods sold (₹) : (d) {(a) × ₹ 90}	4,21,200	17,71,920	1,23,12,000	64,39,500	7,89,750

Customer level operating activities costs					
Order taking costs (₹): (No. of purchase × ₹750)	11,250	18,750	22,500	18,750	22,500
Customer visits costs (₹) (No. of customer visits × ₹ 600)	1,200	1,800	3,600	1,200	1,800
Delivery vehicles travel costs (₹) (₹ 5.75 per km) (Kms travelled by delivery vehicles × ₹ 5.75 per km.)	1,150 (5.75 × 10 × 20)	1,035 (5.75 × 30 × 6)	1,725 (5.75 × 60 × 5)	2,300 (5.75 × 40 × 10)	3,450 (5.75 × 20 × 30)
Product handling costs (₹) {(a) × ₹ 3.75}	17,550	73,830	5,13,000	2,68,313	32,906
Cost of expediting deliveries (₹) {No. of expedited deliveries × ₹ 2,250}	-	-	-	-	2,250
Total cost of customer level operating activities (₹)	31,150	95,415	5,40,825	2,90,563	62,906

(i) **Computation of Customer level operating income**

	Customers				
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)
Revenues (At list price) (Refer to working note)	5,05,440	21,26,304	1,47,74,400	77,27,400	9,47,700

Less: Discount (Refer to working note)	-	35,438	12,31,200	2,57,580	94,770
Revenue (At actual price)	5,05,440	20,90,866	1,35,43,200	74,69,820	8,52,930
Less: Cost of goods sold (Refer to working note)	4,21,200	17,71,920	1,23,12,000	64,39,500	7,89,750
Gross margin	84,240	3,18,946	12,31,200	10,30,320	63,180
Less: Customer level operating activities costs (Refer to working note)	31,150	95,415	5,40,825	2,90,563	62,906
Customer level operating income	53,090	2,23,531	6,90,375	7,39,757	274

Comment on the results:

Customer D is the most profitable customer. D's profits are even higher than C (whose revenue is the highest) despite having only 52.30% of the unit volume of customer C. The main reason is that C receives a discount of ₹ 9 per case while customer D receives only a ₹ 3.60 discount per case.

Customer E is the least profitable. The profits of E is even less than A (whose revenue is least) Customer E received a discount of ₹ 10.80 per case, makes more frequent orders, requires more customer visits and requires more delivery kms. in comparison with customer A.

(ii) **Insight gained by reporting both the list selling price and the actual selling price for each customer:**

Separate reporting of both-the listed and actual selling prices enables Alpha Ltd. to examine which customer has received what discount per case, whether the discount received has any relationship with the sales volume. The data given below provides us with the following information;

Sales volume	Discount per case (₹)
C (1,36,800 cases)	9.00
D (71,550 cases)	3.60
B (19,688 cases)	1.80
E (8,775 cases)	10.80
A (4,680 cases)	0

The above data clearly shows that the discount given to customers per case has a direct relationship with sales volume, except in the case of customer E. The reasons for ₹ 10.80 discount per case for customer E should be explored.

5. (i) **Traditional Absorption Costing**

	BABYSOFT Gold	BABYSOFT- Pearl	BABYSOFT- Diamond	Total
(a) Production of soaps (Units)	4,000	3,000	2,000	9,000
(b) Direct labour (minutes)	30	40	60	-
(c) Direct labour hours (a × b)/60 minutes	2,000	2,000	2,000	6,000

Overhead rate per direct labour hour:

= Budgeted overheads ÷ Budgeted labour hours

= ₹ 1,98,000 ÷ 6,000 hours

= ₹ 33 per direct labour hour

Unit Costs:

	BABYSOFT-Gold (₹)	BABYSOFT-Pearl (₹)	BABYSOFT-Diamond (₹)
Direct Costs:			
- Direct Labour	5.00 $\left(\frac{10 \times 30}{60}\right)$	6.67 $\left(\frac{10 \times 40}{60}\right)$	10.00 $\left(\frac{10 \times 60}{60}\right)$
- Direct Material (Refer working note1)	167.50	215.50	248.50
Production Overhead	16.50 $\left(\frac{33 \times 30}{60}\right)$	22.00 $\left(\frac{33 \times 40}{60}\right)$	33.00 $\left(\frac{33 \times 60}{60}\right)$
Total unit costs	189.00	244.17	291.50
Number of units	4,000	3,000	2,000
Total costs	7,56,000	7,32,510	5,83,000

Working note-1**Calculation of Direct material cost**

	BABYSOFT-Gold (₹)	BABYSOFT-Pearl (₹)	BABYSOFT-Diamond (₹)
Essential oils	120.00 $\left(\frac{200 \times 60}{100}\right)$	165.00 $\left(\frac{300 \times 55}{100}\right)$	195.00 $\left(\frac{300 \times 65}{100}\right)$
Cocoa Butter	40.00 $\left(\frac{200 \times 20}{100}\right)$	40.00 $\left(\frac{200 \times 20}{100}\right)$	40.00 $\left(\frac{200 \times 20}{100}\right)$
Filtered water	4.50 $\left(\frac{15 \times 30}{100}\right)$	4.50 $\left(\frac{15 \times 30}{100}\right)$	4.50 $\left(\frac{15 \times 30}{100}\right)$
Chemicals	3.00 $\left(\frac{30 \times 10}{100}\right)$	6.00 $\left(\frac{50 \times 12}{100}\right)$	9.00 $\left(\frac{60 \times 15}{100}\right)$
Total costs	167.50	215.50	248.50

(ii) Activity Based Costing

	BABYSOFT-Gold	BABYSOFT-Pearl	BABYSOFT-Diamond	Total
Quantity (units)	4,000	3,000	2,000	-
Weight per unit (grams)	108 $\{(60 \times 0.8) + 20 + 30 + 10\}$	106 $\{(55 \times 0.8) + 20 + 30 + 12\}$	117 $\{(65 \times 0.8) + 20 + 30 + 15\}$	-
Total weight (grams)	4,32,000	3,18,000	2,34,000	9,84,000
Direct labour (minutes)	30	40	60	-
Direct labour hours	2,000 $\left(\frac{4,000 \times 30}{60} \right)$	2,000 $\left(\frac{3,000 \times 40}{60} \right)$	2,000 $\left(\frac{2,000 \times 60}{60} \right)$	6,000
Machine operations per unit	5	5	6	-
Total operations	20,000	15,000	12,000	47,000

Forklifting rate per gram = ₹ 58,000 ÷ 9,84,000 grams

= ₹ 0.06 per gram

Supervising rate per direct = ₹ 60,000 ÷ 6,000 hours

labour hour = ₹ 10 per labour hour

Utilities rate per machine

operations = ₹ 80,000 ÷ 47,000 machine operations

= ₹ 1.70 per machine operations

Unit Costs under ABC:

	BABYSOFT- Gold (₹)	BABYSOFT- Pearl (₹)	BABYSOFT- Diamond (₹)
Direct Costs:			
- Direct Labour	5.00	6.67	10.00
- Direct material	167.50	215.50	248.50
Production Overheads:			
- Forklifting cost	6.48 (0.06 × 108)	6.36 (0.06 × 106)	7.02 (0.06 × 117)
- Supervising cost	5.00 $\left(\frac{10 \times 30}{60}\right)$	6.67 $\left(\frac{10 \times 40}{60}\right)$	10.00 $\left(\frac{10 \times 60}{60}\right)$
Utilities	8.50 (1.70 × 5)	8.50 (1.70 × 5)	10.20 (1.70 × 6)
Total unit costs	192.48	243.70	285.72
Number of units	4,000	3,000	2,000
Total costs	7,69,920	7,31,100	5,71,440

(iii) **Comments:** The difference in the total costs under the two systems is due to the differences in the overheads borne by each of the products. The Activity Based Costs appear to be more accurate.

6. Customer Profitability Statement

Particulars	MT Ltd.	KG Ltd.	MG Bros.
Sales (units)	2,000	1,000	800
	(₹)	(₹)	(₹)
Sales Revenue (A)	2,20,00,000	1,10,00,000	88,00,000
Less: Average Variable Cost (B) (` 5,500 × 60% = 3,300 p.u.)	66,00,000	33,00,000	26,40,000
Contribution [70% of Sales]... (A)-(B)	1,54,00,000	77,00,000	61,60,000
Less: Additional Overheads			
Delivery Cost (No. of K.M. × ₹ 200)	2,00,000	1,60,000	1,80,000

Emergency Delivery Cost (Emergency Delivery × ₹ 21,000)	42,000	21,000	-
Order Processing Cost (No. of Orders × ₹ 6,000)	24,000	12,000	48,000
Specific Discount	55,00,000	22,00,000	13,20,000
Sales Commission	33,00,000	11,00,000	4,40,000
Advertisement Cost	8,75,000	6,15,000	4,30,000
Profit <i>per customer</i> *	54,59,000	35,92,000	37,42,000
Profit Margin <i>per customer</i> * (%)	24.81%	32.65%	42.52%
Rank	III	II	I

**Before deducting general fixed overhead cost*

The contribution margin is 70% for each customer but when the other overheads costs per customer is included in the above profitability statement the profitability of the three customers become different. MG Ltd. is the most profitable customer.

7. (i) Calculation of operating income using Activity Based Costing

Calculation of Cost-Driver rate

Activity	Overhead cost	Allocation	Overhead cost	Cost-driver level	Cost driver rate
	(₹)		(₹)		(₹)
Indirect labour + 40% for incentives	56,00,000	50%	28,00,000	300 Production runs	9,333.33
		40%	22,40,000	1052* Setup hours	2,129.28
		10%	5,60,000	4 Number of parts	1,40,000
Computer Systems	20,00,000	80%	16,00,000	300 Production runs	5,333.33

		20%	4,00,000	4 Number of parts	1,00,000
Machinery depreciation	16,00,000	100%	16,00,000	20,000 Machine hours	80
Machine Maintenance	8,00,000	100%	8,00,000	20,000 Machine hours	40
Energy for Machinery	4,00,000	100%	4,00,000	20,000 Machine hours	20

$$* (100 \times 4) + (100 \times 1) + (76 \times 6) + (24 \times 4)$$

$$= (400 + 100 + 456 + 96) = 1052 \text{ setup hours}$$

Activity Based Costing

	Brown	Black	Red	Green	Total
Quantity (units)	1,00,000	80,000	18,000	2,000	2,00,000
	(₹)	(₹)	(₹)	(₹)	(₹)
Sales	1,50,00,000	1,20,00,000	27,90,000	3,30,000	3,01,20,000
Less: Material Costs	50,00,000	40,00,000	9,36,000	1,10,000	1,00,46,000
Less: Direct labour	20,00,000	16,00,000	3,60,000	40,000	40,00,000
Less: 40% incentives on direct labour	8,00,000	6,40,000	1,44,000	16,000	16,00,000
(A)	72,00,000	57,60,000	13,50,000	1,64,000	1,44,74,000
Overheads					
Indirect labour + incentives					
- 50% based on Production runs	9,33,333 (9,333.33 x 100)	9,33,333 (9,333.33 x 100)	7,09,334 (9,333.33 x 76)	2,24,000 (9,333.33 x 24)	28,00,000

- 40% based on Setup hours	8,51,711 (2,129.28 x 400)	2,12,928 (2,129.28 x 100)	9,70,951 (2,129.28 x 456)	2,04,410 (2,129.28 x 96)	22,40,000
- 10% based on number of parts	1,40,000 (1,40,000 x 1)	1,40,000	1,40,000	1,40,000	5,60,000
Computer Systems					
- 80% based on Production runs	5,33,333 (5,333.33 x 100)	5,33,333 (5,333.33 x 100)	4,05,334 (5,333.33 x 76)	1,28,000 (5,333.33 x 24)	16,00,000
- 20% based on number of parts	1,00,000 (1,00,000 x 1)	1,00,000	1,00,000	1,00,000	4,00,000
Machinery depreciation	8,00,000 (80 x 0.1 x 1,00,000)	6,40,000 (80 x 0.1 x 80,000)	1,44,000 (80 x 0.1 x 18,000)	16,000 (80 x 0.1 x 2,000)	16,00,000
Machine Maintenance	4,00,000 (40 x 0.1 x 1,00,000)	3,20,000 (40 x 0.1 x 80,000)	72,000 (40 x 0.1 x 18,000)	8,000 (40 x 0.1 x 2,000)	8,00,000
Energy for Machinery	2,00,000 (20 x 0.1 x 1,00,000)	1,60,000 (20 x 0.1 x 80,000)	36,000 (20 x 0.1 x 18,000)	4,000 (20 x 0.1 x 2,000)	4,00,000
Total Overheads (B)	39,58,377	30,39,594	25,77,619	8,24,410	1,04,00,000
Operating Income (A-B)	32,41,623	27,20,406	(12,27,619)	(6,60,410)	40,74,000
Return on Sales (%)	21.61	22.67	(44.00)	(200.12)	13.53

- (ii) The difference in the operating income under the two systems is due to the differences in the overheads borne by each of the products. The Activity Based Costs appear to be more accurate.

Answers to the Case Scenarios

1.

i.	(b)	ii.	(d)	iii.	(c)	iv.	(b)	v.	(d)
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(i) (b) ₹10,800

(ii) (d) ₹ 4,05,00,000

(iii) (c) ₹ 0

(iv) (b) ₹ 46,82,550

(v) (d) ₹ 61,88,550 & 50,57,325

Working note:

1. Computation of revenues (at listed price), discount, cost of goods sold and customer level operating activities costs:

	Customers				
	A	B	C	D	E
Units sold: (a)	4,500	6,000	9,500	7,500	12,750
Revenues (at listed price) (₹): (b) {(a) × ₹6,480}	2,91,60,000	3,88,80,000	6,15,60,000	4,86,00,000	8,26,20,000
Revenues (at listed price) (₹): (c) (4,500 × {(a) × Actual selling price})	2,91,60,000 (4,500 × 6,480)	3,82,32,000 (6,000 × 6,372)	5,64,30,000 (9,500 × 5,940)	4,69,80,000 (7,500 × 6,264)	7,43,58,000 (12,750 × 5,832)
Discount (₹) (d) {(b) – (c)}	0	6,48,000	51,30,000	16,20,000	82,62,000
Cost of goods sold (₹) : (e) {(a) × ₹5,400}	2,43,00,000	3,24,00,000	5,13,00,000	4,05,00,000	6,88,50,000
Customer level operating activities costs					
Order taking costs (₹): (No. of purchase orders × ₹ 4,500)	67,500	1,12,500	1,35,000	1,12,500	1,35,000
Customer visits costs	7,200	10,800	21,600	7,200	10,800

(₹) (No. of customer visits x ₹ 3,600)					
Delivery vehicles travel costs (₹) (Kms travelled by delivery vehicles x ₹ 7.50 per km.)	1,500	1,350	2,250	3,000	4,500
Product handling costs (₹) {(a) x ₹ 22.50}	1,01,250	1,35,000	2,13,750	1,68,750	2,86,875
Cost of expediting deliveries (₹) {No. of expedited deliveries x ₹ 13,500}	-	-	-	-	13,500
Total cost of customer level operating activities (₹)	1,77,450	2,59,650	3,72,600	2,91,450	4,50,675

Computation of Customer level operating income

	Customers				
	A	B	C	D	E
	(₹)	(₹)	(₹)	(₹)	(₹)
Revenues (At list price) (Refer to working note)	2,91,60,000	3,82,32,000	5,64,30,000	4,69,80,000	7,43,58,000
Less: Cost of goods sold (Refer to working note)	(2,43,00,000)	(3,24,00,000)	(5,13,00,000)	(4,05,00,000)	(6,88,50,000)
Gross margin	48,60,000	58,32,000	51,30,000	64,80,000	55,08,000
Less: Customer level operating activities costs (Refer to	(1,77,450)	(2,59,650)	(3,72,600)	(2,91,450)	(4,50,675)

working note)					
Customer level	46,82,550	55,72,350	47,57,400	61,88,550	50,57,325
operating income					

2.

i.	(d)	ii.	(b)	iii.	(b)	iv.	(d)	v.	(a)
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(i) (d)

Particulars	Olay EV Max (units)	Olay EV Ultra (units)	Olay EV Pro (units)	Total (units)
Previous year order received	616	396	165	1177
Current Year order (5 times the last year)	3,080	1,980	825	5,885
Previous year sales	528	330	110	968
Current Year sales (5 times the last year)	2,640	1,650	550	4,840

(ii) (b) **Statement of gross margin percentage and operating income percentage**

Particulars	Olay EV Max	Olay EV Ultra	Olay EV Pro	Total
Revenues (A) (₹)	22,43,34,000	19,05,75,000	11,97,90,000	53,46,99,000
	(2,640 × ₹ 84,975)	(1,650 × ₹ 1,15,500)	(550 × ₹ 2,17,800)	
Less: Cost of goods sold (B) (₹)	21,78,00,000	18,15,00,000	10,89,00,000	50,82,00,000
	(2,640 × ₹ 82,500)	(1,650 × ₹ 1,10,000)	(550 × ₹ 1,98,000)	
Gross Margin (A - B) (₹)	65,34,000	90,75,000	1,08,90,000	2,64,99,000

Less: Operating costs (₹)				66,23,760
Operating income (₹)				1,98,75,240
Gross Margin %				4.96%
Operating income %				3.72%

(iii) (b) Computation of cost driver rate relating to all the activity areas

Particulars	(₹)
Customer purchase order processing (₹ 17,60,000/ 5,885 orders)	299.07 per order
Line item ordering (₹ 14,04,480/ 66,110 line items)	21.24 per line item order
Store delivery (₹ 15,62,000/ 4,840 unit sold)	322.73 per unit sold
Cartons dispatched (₹ 16,72,000/ 3,39,240 dispatches)	4.93 per dispatch
Shelf-stocking at customer store (₹ 2,25,280/ 2,904 hours)	77.58 per hour

(iv) (d) Computation of operating cost

	Olay EV Max (₹)	Olay EV Ultra (₹)	Olay EV Pro (₹)	Total (₹)
Customer purchase order processing	9,21,136 (₹ 299.07 × 3,080 orders)	5,92,159 (₹ 299.07 × 1,980 orders)	2,46,733 (₹ 299.07 × 825 orders)	17,60,027
Line item ordering	6,54,192 (₹ 21.24 × 10 × 3,080 orders)	5,04,662 (₹ 21.24 × 12 × 1,980 orders)	2,45,322 (₹ 21.24 × 14 × 825 orders)	14,04,176

Store delivery	8,52,007 (₹ 322.73 × 2,640 unit sold)	5,32,505 (₹ 322.73 × 1,650 unit sold)	1,77,502 (₹ 322.73 × 550 unit sold)	15,62,013
Cartons dispatched	2,08,243 (₹ 4.93 × 16 cartons × 2,640 units)	6,50,760 (₹ 4.93 × 80 cartons × 1,650 units)	8,13,450 (₹ 4.93 × 300 cartons × 550 units)	16,72,453
Shelf stocking	20,481 (₹ 77.58 × 2,640 deliveries × 0.1 Av. hrs.)	76,804 (₹ 77.58 × 1,650 deliveries × 0.6 Av. hrs)	1,28,007 (₹ 77.58 × 550 deliveries × 3 Av. hrs)	2,25,292
Operating cost	26,56,059	23,56,890	16,11,013	66,23,962*

*Difference due to rounding off.

(v) (a) **Operating Income Statement**
(using the Activity based Costing system)

	Olay EV Max	Olay EV Ultra	Olay EV Pro
Revenues (₹) (A)	22,43,34,000 (2,640 × ₹ 84,975)	19,05,75,000 (1,650 × ₹ 1,15,500)	11,97,90,000 (550 × ₹ 2,17,800)
Less: Cost of goods sold (₹) (B)	21,78,00,000 (2,640 × ₹ 82,500)	18,15,00,000 (1,650 × ₹ 1,10,000)	10,89,00,000 (550 × ₹ 1,98,000)
Gross Margin (₹) (C) (A - B)	65,34,000	90,75,000	1,08,90,000
Operating cost (₹) (D) (Refer to (iv) part of the answer)	26,56,059	23,56,890	16,11,013
Operating income (₹) (E) (C-D)	38,77,941	67,18,110	92,78,987
Operating income (in %) (Operating income/ Revenue) × 100	1.73%	3.53 %	7.75 %