

UNIT 3

ELEMENTS OF COST: OVERHEAD

Objectives

At the end of this chapter, students should be able to understand:

- The meaning of overhead.
- Understand methods of overhead integration.
- The meaning of overhead absorption.
- Treatment of overhead under/over absorption.

Learning Outcome:

At the end of this chapter, students should be able to:

- Explain the meaning of overhead cost.
- Identify different methods of overhead integration.
- Explain the treatment of overhead absorption
- Prepare the income statement.

M2.3. OVERHEAD

Overhead involves a large number of indirect costs. All materials (such as lubricating oil, consumable materials etc), labour (such as factory supervision, maintenance wages etc) and expense (such as factory rent & rates, insurance etc) are collectively known as overheads. All costs that are not directly traceable to the quantity of goods produced are regarded as overheads. It is more complicated than the calculation of prime cost because it involves all indirect material, indirect labour and indirect expenses.

Overheads are the aggregate of indirect materials, indirect labour and indirect expenses. It is a very important aspect of cost accounting because of a number of reasons namely:

1. It is made up of cost elements: materials, labour and expenses
2. Because of the above, the determination and control is complex and more challenging. In many organizations, the overheads component of total cost is often significant and therefore requires careful analysis, monitoring and control to minimize total cost and thus maximize profit.

As earlier stated, overhead cost consists of indirect material cost, indirect labour cost and indirect expenses. Examples include cost of cleaning materials, cost of stationery, cost of consumable materials, supervision cost, rent and rates etc.

The objectives of overhead cost determination are to:

- a. Enable overhead cost to be absorbed by products and
- b. Provide useful information for management decision making and cost control decisions.

It will be much easier to estimate the cost of material, labour and direct expenses with much accuracy than the overhead cost hence different methods have been utilized to determine or estimate the cost of overhead absorbed into production.

In practice overheads are usually separated into production overheads, administrative overheads, marketing, selling and distribution overheads and research and development overheads.

There are three basic ways that overhead are integrated with the cost of production namely overhead allocation, apportionment, and absorption.

M2.3.1. Overhead Allocation:

This is the transfer of overheads to cost centers directly without sharing. When overhead cost is specifically incurred in respect of a particular cost centre it becomes reasonable to assign or transfer such cost wholly to that cost centre, otherwise referred to as overheads allocation. The allocated overhead becomes part of the cost incurred by the cost centre.

M2.3.2. Overhead Apportionment:

In some situations, certain overhead costs may be jointly incurred by a number of cost centres, in such situation the overhead cost is apportioned to the number of cost center involved using a fair and equitable basis of apportionment. Besides the overhead cost jointly incurred by a number of cost centers, it can equally be incurred by the whole organization. It is equally reasonable to apportion such cost to a number of cost centers available. The basis of apportionment of such overheads which must be fair and equitable could be space occupied by cost centers, number of employees, value of plant etc

M2.3.3. Overhead Absorption:

Overhead absorption is the process of assigning overhead costs to products or services produced. The objective of the overhead absorption process is to include in the total cost of a product or service an appropriate share of the firm's total overheads. The first step is to determine the overhead absorption rate which is applied to determine the overhead absorbed by each unit.

An appropriate share is generally taken to mean an amount which reflects the effort or time taken to produce a unit or complete a job. In order to achieve the desired or appropriate overhead cost, we need to calculate the overhead absorption rate.

Predetermined Calculation of Overhead Absorption Rate (OAR).

Overhead absorption rate is always predetermined. That is, it is calculated prior to the accounting period using estimated or budgeted figures for overheads and units of the absorption base chosen. Of course, the overhead could not have been accurately stated till the end of production likewise the number of units but for proper planning and control these have to be predetermined. This predetermination of the overhead will likely give rise to under or over absorption which will be discussed later in this chapter.

Appropriate Activity Base for OAR Computation.

To determine the overhead absorption rate, different activity base can be used such as direct labour hours, direct wages, direct material, prime cost,

machine hour, cost unit etc. the nature of the operation of the firm determines the base to be adopted as all will give different results. While so many factors may be considered on which activity base to use, it is a matter of judgmental decision. Direct labour hour basis is mostly used in a labour-intensive cost center with an effective time keeping system while direct wages is used where there is only one rate per hour paid throughout a cost center and there is no form of incentive scheme. There could be so many arguments for or against the use of a particular activity base but as earlier stated it mostly depends on the decision of the top management.

Illustration: M 2.3.1

XY manufacturing company provided the following data relating to cost centre 41

	N
Total overhead for the period	
12,000	
Total direct labour hours for the period	320
Total direct wages	N3,200
Total direct material used	N6,000
Total machine hours	2,400
Total units produced	90

Required: from the above data, calculate the overhead absorption rate using

- a. Direct labour hours,
- b. Direct wages,
- c. Direct material,
- d. Prime cost,
- e. Machine hour,
- f. Cost unit

Solution.M2.3.1.

Calculation of Overhead Absorption Rate

- a. Labour hours OAR = $\text{N}12,000/320\text{Hrs}$
= N37.50 overheads per labour hour.

- b. **Direct wages OAR** = $N12,000/3,200$
 = N3.75 overheads per N of wages or 375% of wages
- c. **Direct material OAR** = $N12,000/N6,000$
 = N2 overheads per N of materials or 200% of materials
- d. **Prime cost OAR** = $N12,000/(N3,200+N6,000)$
 = $N12,000/N9,200$ = N1.30 overheads per N1 of prime cost.
- e. **Machine hour OAR** = $N12,000/2,400$
 = N5 overheads per machine hour
- f. **Cost unit OAR** = $N12,000/90$ units
 = N133 overhead per unit produced.

Subsequently a cost unit Y has been produced in cost centre 41 and the following details were recorded.

	Cost unit Y
Direct material used	N46
Direct wages	N55
Direct labour hour	6 hours
Machine hours	34

The management of XY has decided that direct labour OAR is the most appropriate method to use.

Required. Calculate the cost of the cost unit using the data given above.

Solution:M2.3.1.

	Cost unit Y
Direct labour	N55
Direct materials	N46
Prime cost	N101
Overhead (6hrs @ labour hour OAR of N37.50hr*)	N225
Total cost	N326

*Refer to Labour hours OAR calculated above.

Illustration.M2.3.2.

From the above information in illustration M2.3.1 above calculate the overheads which would be absorbed by cost unit X using each of the absorption bases as shown.

Cost unit Y

Direct material used	N46
Direct wages	N55
Direct labour hour	6 hours
Machine hours	34

- a. **Labour hours OAR** = $N12,000/320\text{Hrs}$
= N37.50 overheads per labour hour.

Overhead absorbed using labour hour

No-of hours for cost unit X = 6 labour hours

Therefore (No of hours X OAR = 6×37.50)

Overhead absorbed = N225

- b. **Direct wages OAR** = $N12,000/3,200$
= N3.75 overheads per N of wages or 375% of wages

Overhead absorbed using direct wages OAR

OAR = N3.75 or 375% of wages

Cost unit of Y data = N55

Overhead absorbed = $3.75 \times N55 = N206.25$

OR 375% of N55 = N206.25

- c. **Direct material OAR** = $N12,000/N6,000$
= N2 overheads per N of materials or 200% of materials

Overhead absorbed using direct material OAR

OAR = N2 or 200% of materials

Cost unit of Y data = N46

Overhead absorbed = $2 \times N46 = N92$

- d. **Prime cost OAR** = $N12,000/(N3,200+N6,000)$
= $N12,000/N9,200 = N1.30$ overheads per 130% of prime cost.

Overhead absorbed using prime cost OAR.

OAR = N1.30 or 130% of prime cost

Prime cost unit of Y data = N101

Overhead absorbed = $1.3 \times 101 = N131.30$

- e. **Machine hour OAR** = $N12,000/2,400$
= N5 overheads per machine hour

Overhead absorbed using machine hour OAR

No of machine hours = 34

Overhead absorbed = 34 X N5 = N170

f. **Cost unit OAR** = N12,000/ 90 units
= N133 overhead per unit produced.

Overhead Absorbed Using Cost Unit.

Cost unit of Y data = 1

Overhead absorbed = 1 X 133 = N133

From the above calculations the overheads which would be absorbed by cost unit Y using each of the absorption bases are tabulated below.

BASES	OVERHEAD ABSORBED
a. Direct labour hours,	N225
b. Direct wages,	N206.25
c. Direct material,	N92
d. Prime cost,	N131.30
e. Machine hour,	N170
f. Cost unit	N133

Note the following:

1. The comparative presentation is merely for academic or illustrative purpose.
2. Different calculated overheads shows that there are no single, accurate, best applicable bases. Rather each is based on best acceptable practice of the company.
3. The effect of any adopted bases will lead to either over absorption or under absorption.
- 4.

M2.3.4. Under or Over Absorption.

Sequel to the fact that predetermined rates were used to absorb overheads into actual production throughout the accounting period based on estimated production and estimated overhead, there is every tendency that the overheads absorbed do not totally agree with the actual overhead incurred for the period. This gives rise to under or over absorption. If the overheads absorbed is less than the actual overhead incurred it is known as under absorption but if the overhead absorbed is more than actual overhead incurred, it is known as over absorption. Each of these, under or over has its

effect on the income statement of the company. *The amount of under absorbed overheads should be added to total cost before the profit is calculated, likewise the amount of over absorption should be subtracted from total cost.* Note that it is the actual costs and overhead that determines the profit and not those calculated product costs which include actual prime cost-plus overheads based on a predetermined OAR.

Determination of Overhead Cost:

The ascertainment of overhead cost per unit involves a more complex procedure than the ascertainment of direct expenses. This is because overhead cost consists of indirect material, indirect labour and indirect expenses. The overhead is not only one type of cost and also overheads cost cannot be attributed directly to a cost unit.

Step by Step Procedure:

- a. Divide the organization into cost centers which represent areas of the business, items of equipment or persons with respect to which cost can be gathered and related to cost unit. There are mostly two types of cost center: production and service centers.
- b. Apply allocation method to assign costs wholly incurred by the cost centers to the center.
- c. Overhead costs jointly incurred for more than one cost centre, should be equitably and fairly apportioned among the beneficiary cost centres. Some bases that can be used includes space occupied by cost centers, number of employees, value of plant etc

Cost Center Overhead Cost.

- a. Identify the cost centers whether it is production cost centre (cost center directly involved in the production process or service cost center (cost center that provide services to production cost center.

- b. Re-apportion the overhead cost of the service cost centre to the production cost centres. This is because cost units are not produced in the service cost enters
- c. Determine whether the service cost centres serve each other. That is whether they provide reciprocal services. If not then the following procedure should be followed:
 - i. First re-apportion the service cost centre that serves other service centres, beginning with the service cost centre that serves the largest number of cost centres.
 - ii. Repeat the first process until all service cost centres overheads have been re-apportioned to production cost centres. Note that under these circumstances once a service cost centres overheads have been re-apportioned, that centre does not receive any re-apportioned overheads.

Where the service cost centers provide reciprocal services, it means one service cost centre serves another and receives services from that other. In such a situation the following methods can be used for the re-apportionment.

- i). Simultaneous equation method.
- ii). Continuous allotment method.
- iii). elimination method

Simultaneous equation method: This entails using the information on the total costs apportionable to each service department to form equations. The equations formed are solved simultaneously using elimination method, substitution method or matrix method. The value of the unknown calculated are used for secondary apportionment of the service department.

Continuous Allotment method: this also referred to as repeated distribution method. It entails continuous apportionment to and from the service department until the amount to and from becomes immaterial or insignificant.

Elimination Method: In this method, the cost of service department is apportioned to user departments and once it has been apportioned, it is

eliminated and no subsequent apportionment made to it. Usually, the order of elimination follows the amount of overhead involved with greater attention to the large amount.

Illustration M2.3.3

A company has three production departments and two service departments. The overhead analysis sheet provides the following overhead analyzed to production and service departments

		N
Production Department	1	48,000
	2	42,000
	3	30,000
Service department	X	14,040
	Y	18,000
		152,040

The expenses of the Service Departments are apportioned as follows:

	Production Departments			Service Departments	
	1	2	3	X	Y
Service Department X	20%	40%	30%	-	10%
Service Department Y	40%	20%	20%	20%	-

Required: Apportion the expenses of the Service Departments to the Production Departments using Simultaneous Equation method (elimination method). Show the total overhead of each Production Department after the apportionment in apportionment sheet

Solution M2.3.3

Let X be the total overhead of department X

let Y be the total overhead of department Y

$$\text{Then we have } X = 14,040 + 20\%Y = 14,040 + 0.2Y$$

$$Y = 18,000 + 10\%X = 18,000 + 0.1X$$

$$X = 14,040 + 0.2(18,000 + 0.1X)$$

$$X = 14,040 + 3,600 + 0.02X$$

$$1X - 0.02X = 14,040 + 3,600$$

$$\text{i.e } 0.98X = 17,640$$

$$X = 17,640 / 0.98$$

$$X = 18,000$$

$$\text{then } Y = 18,000 + 0.1X$$

then $Y = 18,000 + 0.1(18000)$

$Y = 18,000 + 1800$

$Y = 19800$

Apportionment

	Production Departments			Service Departments	
	1	2	3	X	Y
Service Department X	20%	40%	30%	-	10%
Share of overhead	3,600	7,200	5,400	(18,000)	1,800
Service Department Y	40%	20%	20%	20%	-
Share of overhead	7,920	3,960	3,960	3,960	(19800)

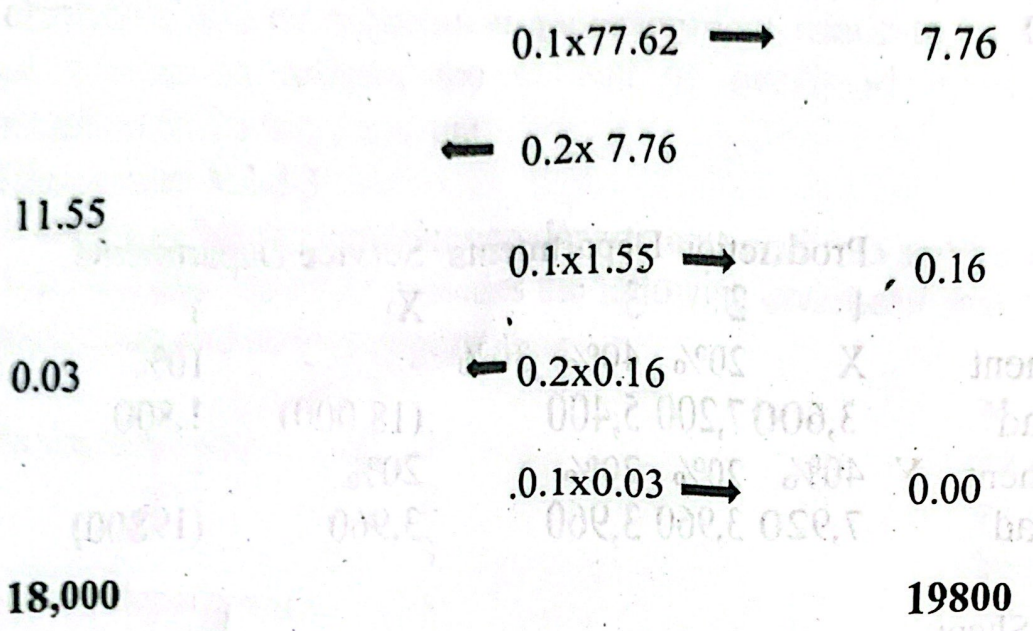
Apportionment Sheet

	Production Departments			Service Departments	
	1	2	3	X	Y
Original allocation	48,000	42,000	30,000	14,040	18,000
Share of overhead X	3,600	7,200	5,400	(18,000)	1,800
Share of overhead Y	7,920	3,960	3,960	3,960	(19800)
Total Overhead	59,520	53,160	39,360	NILL	NILL

Using the above illustration, obtain the values of X and Y for apportionment using the continuous allotment method:

Solution M2.3.3

X Department Amount allotted	Working	Y Department Amount Alloted
N	Original allocations	N
14040	$0.1 \times 14040 = 1404 \rightarrow$	18,000
3,880.8	$\leftarrow 0.2 \times 19,404$	19,404
	$0.1 \times 3,880.8 \rightarrow$	388.08
77.62	$\leftarrow 0.2 \times 388.08$	



The apportionment is done as demonstrated above.

Note: the value of X and Y are the same when using simultaneous equation method and continuous allocation methods

Using the same question, to obtain the values of X and Y using **Elimination Method** for apportionment one proceeds thus:

	1 N	2 N	3 N	X N	Y N
Original Allocation	48,000	42,000	30,000	14,000	18,000
Overhead Apportioned Y	7,200	3,600	3,600	3,200	(18,000)
X apportioned @ ratio of 20:40:30	3,440	6,880	5,160	(17,200)	-
	58,640	52,480	38,760	NILL	NILL

Revision Question

Jonas LTD a manufacturing firm adopts a job costing system. The overhead allocated for its three production cost centres and two service cost centres for the year end 31st December, 20XX are as follows:

Production cost centres overhead	N
Machining line	88,000

Assembly line	64,000
Packaging Line	100,000
Service Cost Centre:	
Purchases and store	40,000
Works and maintenance	72,000

After a thorough study of the records of the firm's service cost centres, as regards the services rendered to other units for the period, it was concluded that the cost of the service centres should be apportioned as follows.

	Machining	Assemble	Packaging	Purchases & stores	Works & maintenance
Purchases & stores in %	30	35	25	-	10
Works & Maintenance in %	45	30	20	5	-

Required: Apportion the service cost centres costs to the production cost centres for the purpose of determining unit cost using simultaneous equation, continuous allocation and elimination Methods.