
Unit 4 □ Allocation of Overhead Cost

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4.1 Introduction

As we have already learnt, all indirect costs (indirect materials, indirect labour, and indirect expenses) are commonly termed as overhead. We also know that indirect costs are by nature not identifiable with a particular cost unit while direct costs (direct material, direct labour and direct expenses) are easily identifiable. Since total product cost is composed of both the direct costs and indirect costs, the incidence of the latter on the product cost must be ascertained. But all the attempts toward that direction are thwarted by the non-identifiability nature of the indirect costs or the overheads. This unit discusses different aspects of overhead in the following sections.

4.2 Classification of Overheads

In line with cost classification process discussed in the previous unit (Unit 3) overheads can also be classified on the basis of :

- i) Elements, ii) Functions, and iii) Behaviours.

i) *Element wise classification* : On the basis of elements, overheads may be classified into *Indirect material*, *Indirect labour*, and *Indirect expenses*. These have been discussed in the previous unit.

ii) *Function wise Classification* : On the basis of the recognized functions of a business, there may be *Manufacturing Overhead*, *Administration Overhead*, and *Selling and Distribution Overhead*. It needs no mention that overhead costs related to manufacturing or production function are Manufacturing or Production Overhead; those incurred for carrying on administrative function are Administration Overhead while Selling and Distribution Overheads are indirect costs related to marketing function.

The components of manufacturing overhead are factory indirect material, indirect labour and indirect expenses. A few examples of manufacturing overheads are : Factory Indirect Materials – Consumable stores, Lubricating oil, Cotton wastes etc.; Factory Indirect Labour – Salaries of Production Management Staffs, Salaries of Foremen, Wages of indirect workers, etc.; Factory Indirect Expenses – Factory rent, Depreciation on Machinery, Power, Fuel, and Factory light.

Administration function covers policy formulation, managerial and controlling activities and other supporting services like secretarial and accounting. Since all these are not directly related to production function, the costs for all these activities are indirect in nature and are termed as administration overhead. Examples may be : Office stationery, Office supplies, Salaries of office staff, Directors' remuneration, Office rent, postage, telephone, Depreciation and maintenance of office equipments, Office lighting and cleaning etc.

Marketing function covers activities related to Selling, Publicity & Advertisement, and Distribution. Expenses on these functions are marketing overhead or more popularly known as selling & distribution overhead. Clearly, this function does not have any direct relation to production; rather, sequentially it arises after the production is complete. Expressly, production is possible without this function. That is why Cost of Production does not include selling & distribution overhead. Similar is not the case of administration function. Services of administration function are essential for both the production and the marketing of the products. Hence, administration overhead is included in Cost of Production. Some examples of selling & distribution overhead are : Salaries, Commission and travelling expenses of sales staff, Cost of catalogues and price lists, sales office expenses, showroom expenses, bad debts, advertising, publicity, cost of packages, warehouse expenses, carriages, insurance, wages of packers, loaders, drivers, etc.

A distinction is, however, made between selling function, distribution function and advertisement & publicity. Marketing is common term encompassing all the above functions. Selling is that part of marketing which aims at securing orders. Publicity includes advertising and promotional activities undertaken to the eventual sale of goods and services. Distribution covers warehousing and delivery of goods and services.

Apart from the above three major functions which are also common to all businesses, there may be another function known as Research and Development which may be undertaken by large firms. Small firms cannot afford to bear the huge costs involved in it. Research cost is the cost of searching for new or improved products, new applications of materials or new or improved methods. Development function involves implementation of the successful research results and ceases with the commencement of formal production by such implementation.

iii) *Behaviour wise Classification* : This basis of classification puts emphasis on the pattern of relationship that exists between the overheads and the volume of output. On that basis overheads are classified into *fixed*, *variable*, and *semi-variable*.

Fixed overheads : The overheads which tend to remain unchanged with the changing levels or volume of production within the specified range of installed capacity. These are mainly the 'time costs' or 'period costs' and hence remain fixed within a given period. So, the fixed overheads per unit gradually come down as the volume of production increases within the installed capacity. Examples of fixed overheads include rent, insurance, depreciation, staff salaries, etc.

Variable overheads : The overheads which tend to vary in aggregate in direct proportion to the changes in the volume of production are known as variable overheads. So, there exists a linear relationship between variable overheads and volume of production. In effect, the variable overheads per unit of output remain fixed for all levels of output within the given range. Indirect materials, indirect labour, power, fuel, lighting and heating, postage, stationery, salesman's commission, etc. fall in this class of overheads.

Semi-variable overheads : These are partly fixed and partly variable. Certain overheads are there which vary with the variation in the volume of production but not in direct proportion. So, these are neither truly fixed nor truly variable. Examples of this type of overheads may be – supervisor's salaries, repairs and maintenance, telephone charges, etc.

4.3 Process in Determining the Amount of Production Overhead in the Unit Cost

Owing to indirect nature, the amount of production overhead in the cost of production of a unit is unlike direct costs, not directly ascertainable. But even in the absence of direct linkage between the amount of expenses and the production unit we want each production unit to be charged with an appropriate share of production overhead (It is equally desired in case of administration and selling & distribution overhead; but we take up the case of production overhead for discussion). With that end in view we may adopt the following steps sequentially :

- i) Classification of overhead
- ii) Collection of overhead
- iii) Distribution of Overheads to Departments :
 - a) By Allocation, b) By Apportionment
- iv) Redistribution to Production Departments
- v) Absorption by Production Units

The first step is to classify an item of overhead expense as production or administration or selling & distribution overhead. The criteria and process of classification have been discussed earlier. So, we take up discussion on the other steps.

4.4 Collection of Overhead

After having classified all the overhead expenses into production, administration and selling and distribution overhead, items of expenses under each such class of overheads are required to be grouped further in order to bring similar expenses under one account heading. A list of account heads is kept prepared beforehand. The size of the list, long or short, is not standardized; it all depends on the nature and types of expenses that generally occur. It will ensure more effective analysis and control of overhead expenses owing to uniformity and accuracy in collecting them. For such grouping and sub-classification, usually a system using code numbers/symbols is used. Code numbers used for identifying expenses as Production Overhead are known as *Standing Order Numbers* while those used for administration and selling and distribution overhead are termed as *Cost Accounting Numbers*.

As soon as a transaction occurs involving an item of overhead expenses, the source document (invoice, stores requisitions, wages analysis sheet, cash memos, etc.) is analysed primarily to identify whether it is an item of production overhead or of administration and selling and distribution overhead. Analysis is continued to identify the department responsible for the expense and also to identify the group (for similar items) to which the item can be collected. For example, expenses on cotton waste and lubricating oil (both are indirect materials and can be brought under one group, 'maintenance') incurred by Production Department 'D' can be allotted a standing Order Number like '010405'. The first two digits '01' may indicate that the expenses are items of Production overhead; the digits '04' indicate Production Department 'D' and the last two digits may be used to indicate the group 'maintenance'.

As the above example of coding uses only numerals it is called 'Decimal Method' of coding. There are, in fact, other methods of coding also. The method which uses only alphabets (e.g., SA for Sales, SAL for Salaries, DEP for Depreciation, etc.) is known as 'Mnemonic Method'. Codes may also use both the numerals and the

alphabets (e.g., S1 for Salaries of Foremen, S2 for Salaries of Gangboss, D1 for Depreciation on Plants, D2 for Depreciation of Buildings, etc.).

4.5 Distribution of Overheads to Departments

There are generally two types of departments in a factory; some are production departments where products are produced while there may be other departments in which no production operation is carried on but these departments are meant for providing some support services for the production departments. These latter types of departments are termed as service departments. Examples of service departments may be : Canteen, Stores, Personnel, Accounts, Boiler House, etc. Overhead expenses are incurred at both the types of departments. But there may be some common expenses incurred for both the production and service departments. These common expenses are to be distributed amongst all the departments (both the production and service departments) benefited in proportion to the services received by them. For such distribution of common expenses some surrogate measures (alternative bases) are identified which are themselves identifiable with the departments and at the same time having nearest relation with the expenses. For example, general electricity expenses may be distributed amongst the departments on the basis of points of consumption in various departments for lights and fans or on the basis of area occupied by the departments (assuming that light and fan points get multiplied on the basis of increase in area to be served). An illustrative list showing some common expenses and their corresponding bases suggested to be used for distribution is given below :

Items of Expenses	Basis of Distribution
Rent, Rates and Taxes	Floor space occupied
Insurance, Depreciation and repairs of Buildings	— Do —, or Value of buildings
Insurance, Depreciation and Repairs to Plant and Machinery	Plant Value
Insurance of Stock	Value of stock
Lighting	Light points or Area occupied
Power	Horse Power of Machines
Supervision, Canteen, Time-keeping, Medical	No. of workers
Internal transport	No. of requisitions, Weight or Value of materials/stores supplied

The distribution of overheads to departments by direct identification and/or by indirect proportionate sharing on some suitable bases leads to determination of the amount for each department. The process involved in the determination of the

overheads of the departments is known as *Departmentalisation*; it is also termed as *Primary Distribution*. Thus, the amount of overheads of a department as arrived at after primary distribution consists of :

- a) the amount of overheads directly identified with the department, and
- b) the share of common overheads assigned to the department.

The process involved in determining the first part is known as *Allocation*. Allocation is 'the allotment of the whole items of cost to cost centers or cost units'. The process involved in determining the second part (proportionate share) is what is termed as '*Apportionment*'. Apportionment is, therefore, the allotment of an item of overhead to two or more cost centers on an estimated basis of benefit received by them.

4.6 Distinction between Allocation and Apportionment

The main distinction between allocation and apportionment lies in the degree of accuracy in ascertaining the amount of overhead that can be reasonably charged to a cost centre. With regard to that allocation appears to be more accurate at least so far as ascertainment of cost centre level overhead is concerned. Because, process of allocation is adopted only when an item of overhead is identified with a particular cost centre. On the other hand, apportionment identifies a cost center's share in an item of overhead only approximately. The process of apportionment is adopted when no direct measure is available to ascertain the cost center's share in an item of overhead. For example, it is not possible to accurately identify the rent of a Department when a consolidated amount is paid as rent for the entire building which houses a number of such departments. In such a case an approximate share of rent is identified as the rent of a department by resorting to the process of apportionment based on the proportions of area occupied by the departments. Area is only one of the factors, may be the major and the most important one, on which rent depends. Other factors may be geographical location, lighting and ventilation, nearness to the locations of the service facilities, etc. Apportionment on the basis of area ignores all other factors. That way, apportionment on 'the most appropriate' basis possible gives only 'next to accurate' solution. Explicitly, the degree of accuracy depends on the selection of an appropriate basis of apportionment.

The more appropriate is the basis the more accurate is the distribution. The appropriateness of a basis of apportionment depends on the closeness of its relationship with the overhead. Choice between allocation and apportionment is also a matter neither of discretion nor of a feature of the overhead but of the relationship between the overhead and the cost centre or cost unit.

4.7 Redistribution to Production Departments

Service departments do not have any production; so there is no revenue earnings in these departments. Naturally, the cost incurred in these departments including the direct costs, if any, and also that apportioned to them are necessarily to be transferred to the production departments for subsequent absorption by the production units so that these costs too can be recovered out of revenues. It may be specifically mentioned that direct cost of service departments and overhead costs are to be treated alike for the purpose of redistribution.

Usually a service department renders services to a number of departments which may include both the production and service departments. If, however, a service department renders services to a single department, the process of *allocation* is resorted to while *apportionment* is adopted when two or more departments receive services of a service department. Since this is the second time distribution of overhead is made (the first time in primary distribution as stated earlier), such redistribution is also known as *Secondary Distribution*.

For apportionment of service department overheads, again some suitable bases are to be identified just like those found necessary in case of primary distribution. There may be a number of considerations which govern the selection of a suitable basis for redistribution by apportionment. The most popular amongst them is the proportion in which the services are received by the departments. The other considerations may be the 'ability to bear the burden' i.e., to charge the department more which earns more, the 'survey' conducted for the purpose (e.g., the cost of a centralized PBX department may be apportioned on the basis of a survey of the records indicating the department using the service), etc. An illustrative list showing some common service department costs and the corresponding bases commonly used is given below :

Cost of the Service Department	Commonly Used Bases
1. Purchase	No. of purchase requisitions No. of purchase orders Quantity or Value of Materials purchased
2. Stores	No. of stores requisitions Quantity or Value of stores issued
3. Canteen	No. of employees
4. Accounts	No. of employees
5. Power House	Metered consumption of power Horse Power-Hours
6. Inspection	Inspection time spent

7. Tool Room	Direct labour hours Direct machine hours Direct wages
8. Repairs & Maintenance	Hours worked Asset value x hours worked
9. Time-keeping	No. of employees Labour hours Direct wages
10. Medical Unit	No. of employees No. of cases attended

4.7.1 Methods of Redistribution

Basically there are three different methods for redistribution (rather reapportionment) of service departments' overheads to production departments. The methods differ on the basis of whether interdepartmental services amongst the service departments are there and recognized or not. The methods, however, are :

- i) Direct Redistribution,
- ii) Step Method, and
- iii) Reciprocal Services Method.

These methods are discussed below in brief.

i) *Direct Redistribution* : This method is used when there is no case of services being rendered to other service departments or even if there be any such case that is ignored for the purpose of redistribution. In other words, service departments' overheads are directly distributed only to the various production departments selecting suitable bases.

ii) *Step Method* : This method takes into account the services rendered by service departments to other service departments only partially on a non-reciprocal basis. In this method, redistribution of the overheads of the service department rendering services to the highest number of other service departments but not receiving any service from other departments is taken up first. Second to choose is the service department that ranks second in the number of other service departments to which it renders services but does not receive services from them. The process continues until the overheads of all the service departments are apportioned to the production departments. The point to note here is that this method recognizes services rendered by one service non-reciprocally i.e., recognizes only to the extent where a service department does not render services to a service department from which it receives services.

Illustration 1 (Step Method)

The costing records of a company having three production departments and three service departments show the following data for the year ended 31st December, 2004 :

Particulars	Production Departments			Service Departments		
	P ₁	P ₂	P ₃	S ₁	S ₂	S ₃
Direct Materials (Rs.)	9,000	10,500	7,500	1,500	3,000	4,500
Direct Wages (Rs.)	15,000	12,000	16,000	4,000	2,000	1,000
Floor Space (Sq. ft.)	2,400	1,800	1,200	1,200	600	600
Light Points (No.)	40	20	30	20	10	15
Electricity (KWH)	4,000	3,500	2,500	500	1,500	1,000
No. of Employees	70	50	30	10	30	10
Value of Machines (Rs.)	60,000	1,50,000	80,000	10,000	5,000	20,000
Value of Stock (Rs.)	40,000	60,000	30,000	—	20,000	—

The expenses incurred during the year were :

Fire Insurance Rs. 3,000, Canteen expenses Rs.6,000, Stores expenses Rs.7,200, General Electricity Rs.5,400, Motive Power Rs.10,400, Rent Rs.15,600, General Overhead Rs.5,000 Depreciation on Machines Rs.13,000, Repairs and Maintenance Rs.6,500.

Apportion the costs of the service departments to the production departments assuming the following pattern of rendering services by the service departments :

Service Departments	% of services rendered					
	P ₁	P ₂	P ₃	S ₁	S ₂	S ₃
S ₁	40	30	20	—	—	10
S ₂	10	20	40	10	—	20
S ₃	30	40	30	—	—	—

Solution :

Statement Showing Primary Distribution of Overhead

Items of expenses	Basis of Distribution	Total Amount Rs.	Production Departments			Service Departments		
			P ₁ Rs.	P ₂ Rs.	P ₃ Rs.	S ₁ Rs.	S ₂ Rs.	S ₃ Rs.
Fire Insurance	Value of stock (4:6:3:0:2:0)	3,000	800	1200	600	—	400	—
Canteen Expenses	No. of employees (7:5:3:1:3:1)	6,000	2100	1500	900	300	900	300
Stores Expenses	Direct Materials (6:7:5:1:2:3)	7,200	1800	2100	1500	300	600	900
General Electricity	Light Points (8:4:6:4:2:3)	5,400	1600	800	1200	800	400	600
Motive Power	KWH (8:7:5:1:3:2)	10,400	3200	2800	2000	400	1200	800
Rent	Floor Space (4:3:2:2:1:1)	15,600	4800	3600	2400	2400	1200	1200
General Overhead	Direct Wages (15:12:16:4:2:1)	5,000	1500	1200	1600	400	200	100
Depn. on Machines	Machine Value (12:30:16:2:1:4)	13,000	2400	6000	3200	400	200	800
Repairs & Maintenance	—Do—	6,500	1200	3000	1600	200	100	400
Direct Materials	Allocation	9,000				1500	3000	4500
Direct Wages	Allocation	7,000				4000	2000	1000
		88,100	19,400	22,200	15,000	10,700	10,200	10,600

Secondary Distribution Summary

Departments	Overheads as per Primary Distribution Summary				
	Rs.	Rs.	Rs.	Rs.	Rs.
S ₂	10200	(-) 10200	Rs.		
S ₁	10700	(10%) 1020	(-) 11720	Rs.	
S ₃	10600	(20%) 2040	(10%) 1172	(-) 13812	Rs.
P ₁	19400	(10%) 1020	(40%) 4688	(30%) 4144	29252
P ₂	22200	(20%) 2040	(30%) 3516	(40%) 5525	33281
P ₃	15000	(40%) 4080	(20%) 2344	(30%) 4143	25567
	88100				88100

iii) *Reciprocal Service Method* : Reciprocal service means exchange of services between two service departments. As the name suggests this method recognizes such exchange of services. Resultantly, after distribution of overheads of a service department *inter alia* to another service department for the portion of services rendered to the latter, a proportionate part of the latter department's overhead (comprising its own overhead and those distributed to it) should be distributed back to the former department for the reciprocal services received by it.

There are two alternative methods to deal with the reciprocal services :

- (a) Repeated Distribution, and
- (b) Simultaneous Equation.

Repeated Distribution Method suggests continuing the process of distribution (obviously apportionment) of the service departments' overheads to other service departments and production departments. Because, as pointed out above, it is not an one-shot operation to distribute the overheads of a service department exhaustively when there are reciprocal services. In fact, repeated distribution in a cyclical manner leaves too negligible a balance of overhead in the service department to distribute it further. The process of repetition is continued to that end. The process is illustrated below :

Illustration 2 (Repeated Distribution Method)

A manufacturing company has three Production Departments and two Service Departments. The departmental overheads for a month as arrived at after Primary Distribution are as follows :

		Rs.	Rs.
Production Departments :	P ₁	19,400	
	P ₂	22,200	
	P ₃	<u>15,000</u>	56,600
Service Departments :	S ₁	10,200	
	S ₂	<u>10,700</u>	<u>20,900</u>
	Total		<u>77,500</u>

The Service Departments render services to other departments roughly in the following pattern :

Service Departments	Production Departments			Service Departments	
	P ₁	P ₂	P ₃	S ₁	S ₂
S ₁	30%	40%	10%	—	20%
S ₂	20%	30%	40%	10%	—

Prepare a statement showing the apportionment of the overheads of the service departments to the production departments :

Solution (Repeated Distribution Method)

Secondary Distribution Summary

Particulars	Production Departments			Service Departments	
	P ₁ Rs.	P ₂ Rs.	P ₃ Rs.	S ₁ Rs.	S ₂ Rs.
Departmental Overheads (as per Primary Distribution)	19400	22200	15000	10200	10700
Service Dept. : S ₁	3060	4080	1020	(-) 10200	2040
S ₂	2548	3822	5096	1274	(-) 12740
S ₁	382	510	127	(-) 1274	255
S ₂	51	76	102	26	(-) 255
S ₁	8	10	3	(-) 26	5
S ₂	1	2	2	—	(-) 5
Total	25450	30700	21350		

Note : Fraction of a rupee apportionable to S₁ in the last round has been ignored.

Simultaneous Equation Method is an alternative method to ascertain the total overhead of a service department taking into account all its shares in repeated reapportionments. It is done with the help of simultaneous equation – hence such a nomenclature of the method. Once the gross distributable amounts of each service departments are thus ascertained algebraically, it then becomes very simple to just distribute the amounts only amongst the production departments in proportion to the given percentages of rendering services to them.

The above problem as used to illustrate the repeated distribution method is used to illustrate this method.

Solution (*Illustration 2 – Simultaneous Equation Method*)

Let x = Total overhead of Service Department S_1

y = Total overhead of Service Department S_2

Conditionally,

$$x = 10,200 + 10\% \text{ of } y,$$

$$y = 10,700 + 20\% \text{ of } x$$

$$\text{or, } x = 10,200 + 1/10 \text{ of } y$$

$$\text{or, } 10x = 1,02,000 + y \quad \dots\dots(i)$$

$$y = 10,700 + \frac{1}{5}x$$

$$\text{or, } 5y = 53,500 + x \quad \dots\dots(ii)$$

Equation (i) is multiplied by 5 :

$$50x = 5,10,000 + 5y \quad \dots\dots(iii)$$

$$x = (-) 53,500 + 5y \quad \dots\dots(iv)$$

Subtracting eqn.(iv) from eqn.(iii), we get, $49x = 5,63,500$

$$\text{or, } x = 11,500$$

Putting the value of x in eqn.(ii), we get, $5y = 53,500 + 11,500 = 65,000$

$$\text{or, } y = 13,000$$

Thus, Total overheads of S_1 and S_2 taking reciprocal services into account are Rs. 11,500 and Rs.13,000 respectively. These are now redistributed only to the production departments as shown below :

Statement showing redistribution of service department overheads to production departments

Particulars	Production Departments			Service Departments	
	P ₁ Rs.	P ₂ Rs.	P ₃ Rs.	S ₁ Rs.	S ₂ Rs.
Overheads (as per Primary Distribution)	19,400	22,200	15,000	—	—
Overheads (as computed above)	—	—	—	11,500	13,000
Service Dept. :					
S ₁	3,450	4,600	1,150	(-) 11,500	—
S ₂	2,600	3,900	5,200	—	(-) 13,000
Total	25,450	30,700	21,350		

The total overheads of production departments after redistribution under repeated distribution method and simultaneous equation method may be verified.

4.8 Absorption of Overheads by Production Units

Absorption of overheads means charging an equitable proportion of the total overhead of a production department to production unit. It is the ultimate stage of recognizing production overhead as a part of the cost of production. It means no mention that the process of apportionment, not the allocation, is to be resorted to again. Naturally, an appropriate measurable base is to be identified and the total amount of production overhead is to be spread over all the measured units of that base. A base is a factor which significantly influences the costs of a department. It is alternatively known as the *cost driver*. A production department may have a number of cost drivers such as production units, direct materials, direct labour (hours/wages), machine hours, a combination of material and labour cost i.e., prime cost, etc. The amount of production overhead per unit of the base used is known as *Overhead Absorption or Recovery Rate*. The output as measured in terms of the base used (e.g., direct materials cost per unit, direct wages per unit, direct labour hours per unit, machine hours per unit, etc.) is multiplied by the absorption rate (e.g., overheads per rupee of direct materials or direct wages, per direct labour or machine hour, etc.) to determine the amount of overhead per unit. This is what is known as *absorption of overhead* by production units.

The overhead absorption or recovery rate may be either actual or predetermined. This rate may again be computed either for the factory as a whole comprising a number

of production departments or separately for each department or cost centre; while the former is known as single rate, the latter rates are called multiple rates. Usually, a rate whether it is actual or predetermined, single or one of the multiples, is computed once for a whole year. But in cases when both the amount of overhead and/or the base used undergo a change more frequently say, changes take place every month or quarter or for any shorter period (e.g., changes in direct wages or labour or machine hours in a month due to variation in number of working days) or when they change due to seasonal fluctuations, the rate should be computed for a period so as to match the period of fluctuation. Accordingly, there may be seasonal or other periodical rates like monthly, quarterly, daily, etc.

Actual Rate vs. Pre-determined Rate

Actual overhead rate is the rate which is computed on the basis of actual figures. Thus,

$$\text{Actual Rate} = \frac{\text{Actual Overheads}}{\text{(Actual number of units of the base used)}}$$

Actual rate may be computed for any period say, monthly, quarterly, half-yearly or annual.

Actual rate is very simple to understand and may be more acceptable for its objectivity (independent of the mind of the person using it). It can be suitably used for computation of historical cost of production. But it suffers from two major limitations :

(a) The rate may be computed only at the end of the accounting period (month, quarter, half-year or year) when actual figures are available. So, it may be used only for post-mortem exercise. It becomes useless in determining selling price where the latter is based on cost of production. Because cost of production using actual overhead rate can be computed only at the end of a period while both the productions and sales operations are carried over throughout the period.

(b) Actual rate is sensitive to the periodical fluctuations in both the volume of production and the overhead costs. Different rates in different periods make the costs of production and the selling prices incomparable over the periods. Frequent changes in selling prices may affect the volume of sales adversely.

Pre-determined overhead rate, as the name suggests, is determined beforehand i.e. before the commencement of the period over which it would be used. Naturally, it is based on budgeted figures which are then available.

Thus,

$$\begin{aligned} &\text{Pre-determined Overhead Rate} \\ &= \frac{\text{Budgeted overhead for the period}}{\text{Budgeted number of units of the base used}} \end{aligned}$$

Following arguments are usually put-forward in favour of the use of a pre-determined rate :

- (i) The rate becomes available rightly at the beginning of the period since budgets are always prepared beforehand. It thus helps in avoiding the delay in computing the cost of production and the selling price. It is, therefore, more suitable for application in jobbing type of industries.
- (ii) Once the rate is computed it can be used throughout the entire period without any change. As a result, it brings in uniformity in the unit cost over the period and avoids the onslaught of fluctuations in productions (base) and overhead costs.
- (iii) The pre-determined rate is very much useful for control and decision making purposes since they generally require use of data in advance of the actual operation.

Single vs. Multiple Rate

A single absorption rate for the factory as a whole is also known as *blanket* rate. If the products of a factory are more or less identical and all of them receive similar services from all the departments or cost centers, use of a single rate may be recommended. It is actually an average rate for all the departments.

Time, cost and energy involved in computing different rates for different departments can be avoided by use of a single rate. Single rate is thus suitable for small firms. These advantages of single rate are, however, available only to the sacrifice of accuracy. For example, in a multi-product firm where different products have to use services of different departments or cost centers disproportionately, use of single rate gives inaccurate product costing.

In such cases, multiple rates i.e., different rates for different departments, are to be used for more accurate absorption of overheads.

Annual vs. More Frequent Periodical Rates

An actual rate or a pre-determined one may be used either as a single rate or in multiples. But in either case a decision is to be taken as to the length of the period during which the rate will be used. In other words, it is an issue of how frequently

the rate should be revised. The absorption rate is usually computed on an annual basis so as to match the use-period with the normal accounting period. This is particularly so in case of pre-determined rate. But in case of actual rate, annual revision suffers from the limitation of getting delayed as stated earlier. More frequent revision may ease out the problem significantly but may invite another problem of fluctuating product cost.

Some businesses may be more sensitive to cyclical fluctuations; business ups and downs in those cases coincide with the phases of business cycles. Overhead rate in those businesses should be used continually over the period so long as to cover all the phases of the business cycle which usually extends beyond one year.

4.9 Methods of Overhead Absorption

There are different methods of charging overhead to unit cost of a product. The methods differ depending on different bases (Direct Materials, Cost per unit, Direct labour hours / wages per unit, Unit prime cost, etc.) used in computing the overhead absorption rate. All the methods are discussed below in brief classifying them under three broad groups :

- A) Production Unit method
- B) Percentage methods :
 - i) Percentage on Direct Materials Cost
 - ii) Percentage on Direct Wages
 - iii) Percentage of Prime Cost
- C) Hourly Rate methods :
 - i) Direct Labour Hour Rate
 - ii) Machine Hour Rate

- **Production Unit Method**

Under this method overhead rate is computed by dividing the total overhead cost directly by the number of units produced i.e.,

$$\text{Overhead Rate} = \frac{\text{Total overhead cost}}{\text{Total no. of units produced}}$$

The rate may be an actual or a pre-determined one. The base used here is the volume of production which may also be measured, if possible, in terms of the units of common characteristics like weight, length, volume, etc. This method is suitable for use in a single-product firm or even in a multi-product firm where all the products

may be measured in terms of some common unit as above. The suitability of this method is, however, based on the assumption that the overhead cost is mainly influenced by such common characteristic.

- **Percentage on Direct Materials Cost Method**

Under this method,

$$\text{Overhead Absorption Rate} = \frac{\text{Total Overhead Cost}}{\text{Total Direct Materials Cost}} \times 100$$

This method is rarely applied since a meaningful relationship between overhead cost and direct material cost is rarely found. It is totally unjustified to charge higher amount of overhead simply because the product consumes expensive material. Again, materials price is subject to greater and frequent fluctuations while prices of different items of overhead may not. Thus, total overhead cost remaining same, higher or lower amount of overhead may be charged to product unit due to fluctuations in the prices of materials used. Finally, this method ignores the time factor while most of the items of overhead cost are time-based. For example, two products having the same materials cost will bear the same amount of overhead charge even though they are having different processing times attracting different incidence of rent (an overhead item).

- (i) **Percentage on Direct Wages Method**

This method is similar to the earlier method the only difference being replacement of direct materials cost as base by direct labour cost or direct wages. Thus,

$$\text{Overhead Absorption Rate} = \frac{\text{Total Overhead Cost}}{\text{Total Direct Wages}} \times 100$$

This method can be suitably used in the following situations :

- i) Where production process is labour intensive demonstrating a close relationship between overhead cost and direct wages.
- ii) Where all workers are paid at a uniform rate. Different rates of pay for different workers mean different direct wages for uniform time involving uniform overhead cost. So, overheads may be charged not in proportion to their accruals.
- iii) Where there is uniform production process for all the products. Different production processes usually involve different overhead costs.

The advantages of this method are :

- (a) It is very simple.
- (b) Time factor which is the most influential one in accrual of overhead cost is duly recognized in this method.

- (c) Labour rate is more stable than material price. So, incidence of overhead cost on the cost of production also remains stable in different periods.

The major limitation of this method is ignoring the fact that production involving more machine-time usually leads to more overhead cost.

(ii) Percentage on Prime Cost Method

Under this method, prime cost being a composition of all the direct costs is used as base. It is not a widely used method. Because it attracts all the limitations of using both the direct material cost and direct wages as bases while attempting to derive their advantages. The only weak argument put forward in its favour is that overhead cost is mainly associated with the direct material and labour.

● **Direct Labour Hour Rate Method**

Labour Hour Rate is computed as given below :

$$\text{Hourly Rate} = \frac{\text{Total Overhead Cost}}{\text{Total Direct Labour Hours}}$$

This method is considered to be superior to any of the methods discussed above. Because this method accords real recognition to the time factor which is believed to have major influence on the overhead cost. It is more suitable in labour intensive manufacturing firms particularly when there are different rates of wage payment. It is, however, not suitable in machine intensive manufacturing firms.

● **Machine Hour Rate Method**

Under this method overhead cost is absorbed by machine-hours used for production. This method is suitable where production operation is highly mechanized. In such cases machine related costs like depreciation, repairs and maintenance etc. dominate the overhead cost. Machine related costs do usually have direct relation with the machine running time.

Where a number of dissimilar machines are in use rates are to be computed separately for each such machine. If, however, all the machines are similar, one rate may be computed for all the machines. Different rates for different groups of similar machines may also be computed. In either case, overhead costs are first allocated or apportioned to each of the different dissimilar machines or to each group of similar machines. Each machines or each group of machines is treated as a cost centre. Once the process of allocation and/or apportionment is completed computation of machine hour rate is very simple. It just involves dividing the overhead cost of a machine cost centre by the machine hours for that cost centre.

Again, machine related costs are not specific to the machine running time. Some costs may be incurred even when the machines remain idle. Running time costs are usually variable in nature while idle time costs are mainly fixed. So, absorption of overhead cost by a single rate taking both the single and variable machine costs together may be inequitable. Computation and application of separate rates for running and idle hours may ease out the problem of inequitable absorption of overhead.

Additionally, possibility of treating wages of operators either as direct or as indirect creates confusion. If treated as direct wages, normally it should not be included in computation of machine hour rate. But if it is considered worthwhile to include it in the computation of machine hour rate, it being a significant item of machine related cost, it is to be included as a variable item. The machine hour rate so computed is known as Comprehensive Machine Hour Rate. It may be included in the group of fixed expenses if an operator cannot be terminated even in case of falling demand and production.

4.10 Limitation of the Volume-based Methods

Different methods of absorption of overhead have been discussed above. The process in each case is simple and similar i.e., dividing the amount of overhead by the base used. The bases used in the above methods are – production units, direct materials cost, direct wages, prime cost, direct labour hours and machine hours. All these bases may be used as measures of the volume of production. Hence, the methods are alternatively called volume based methods. As the volume increases, the absorption rate decreases and vice-versa. Consequently, a product or service is charged with higher amount of overhead if it consumes higher volume of resource (direct material, direct labour, machine time, etc.) that is used as base in determining absorption rate. For example, overhead cost (consisting of set up cost and other batch-specific costs) for a batch volume of 1000 units of a product in a plant should be the same for a batch-volume of 100 units of a similar product (in all respects) in another plant. So, incidence of overhead cost on the unit cost of the product should be rationally lower in the first plant (amount of overhead being distributed over 1000 units in a batch) than that of the second plant (same amount of overhead being distributed over 100 units in a batch). But traditional costing system using volume-based method of overhead absorption (say, 100% of direct wages) will lead to equal incidence of overhead on the unit cost in both the plants; because direct wages per unit are equal in both the plants. So, volume-based overhead distribution method leads to mis-costing i.e., under-costing of low-volume products and over-costing for high-volume products. This misinformation in cost may in turn lead to wrong decisions (pricing, subsidy allocation, resource allocation, etc.).

Of the different volume-based methods, direct labour based methods are the most popular ones in use. These methods have become consistent and conventional in use. The underlying logical assumption is that most of the items of indirect cost are more related to direct labour. But things have undergone havoc change in the recent past. With the introduction of more and more automatic and advanced manufacturing techniques the importance of direct labour has declined. It may be evident from the observations of a few studies conducted between 1960 and 1986 (collected from “Activity Based Costing, by N.S. Acharya, The Management Account, 1996, p.520). One of the studies revealed that share of direct labour in total cost reduced from 22% to 15% while that of indirect costs increased from 22% to 32%. But interestingly, despite the declining importance of direct labour, its use as a base, for absorbing overhead was on the rise from 40% to 50% of the organizations studied. So, in spite of lost relevance of direct labour its increasing use as a base for overhead absorption may be due to more affinity to consistency and convention.

4.11 Under- or Over-absorption of Overhead

As discussed earlier, actual overhead absorption rate is seldom used owing to lack of its practical utility in determining cost of production and selling price. Selling price is required to be determined as soon as the goods are ready for sale; it may be well ahead of the end of the accounting period. So, overhead is recovered based on predetermined rate.

The amount of overhead cost charged to product cost applying the pre-determined rate is known as the amount of overhead *recovered*. For example, if Production Unit Method of recovery is applied then :

$$\begin{aligned} \text{Overhead recovered} &= \text{Actual production} \times \text{Recovery rate per unit} \\ &= \text{Actual Production} \times \frac{\text{Estimated or Budgeted Overhead}}{\text{Estimated or Budgeted Production}} \end{aligned}$$

Naturally, the amount of overhead recovered is only an estimated figure which creeps into the product cost. But product cost for accounting purposes must be an actual one. Actual overhead costs are incurred independent of this process of recovery. These are just collected and accounted for by debit to Production Overhead Account (Accounting for cost transactions, is a matter of discussion for the next unit). If, incidentally, two figures of *overhead recovered* and *overhead incurred* exactly match, which is a rare occasion, there will be no problem since product cost will reflect the actual cost.

The problem arises when the two figures of overhead recovered and the overhead incurred do not match. There may be two situations of such a mismatch :

i) When the amount of overhead recovered falls short of overhead incurred. It is termed as *under-recovery* or *under-absorption of overhead*.

ii) When the amount of overhead recovered exceeds the amount of overhead incurred. It is termed as *over-recovery* or *over-absorption of overhead*.

In either case, product cost will show a distorted picture.

Identifying the basic reasons behind under-or over-recovery of overhead becomes very simple. These are :

i) When actual overhead incurred differs from overhead estimated as used in determining recovery rate. Under-estimation of overhead leads to lower rate of recovery which in turn leads to lower recovery or under-absorption and vice-versa.

ii) When actual figures for the base elements (production unit, labour hours, etc.) differ from the estimated figures. Under-estimation of base element leads to higher rate of recovery and consequential higher recovery or over-absorption and vice-versa.

Further analyses of causes as to why actual figures of overhead and base elements differ from those estimated may reveal the following :

a) Demand-supply factor in production. Production may be increased to meet the increased demand and vice-versa.

b) Mistakes in estimating the figures either of overhead or of base element.

c) Unforeseen changes affecting the amount of overhead and the base element e.g., change in overhead prices, change in production methods, etc.

d) Seasonal fluctuations.

● **Treatment of under-or over-absorbed overhead :**

There are three alternative ways of treating under-or over-absorbed overhead in cost accounts. These are :

i) Carry forward to the next accounting period,

ii) Write off to Costing Profit and Loss Account,

iii) Adjust product cost by use of Supplementary Rate.

Carry Forward Method : Under this method the amount of under-or over-absorbed overhead is transferred to an Overhead Suspense Account which is carried forward to the next period with the hope that it may be neutralized by an opposite balance next period. This method is seldom applied but suitable to counter the effects of business cycle which extends beyond one accounting period.

Write off Method : The amount of under-or over-absorbed overhead is transferred to a separate account called Overhead Adjustment Account. This is to collect under-

and over-absorbed amounts of all types of overheads namely, production overhead, administrative overhead and selling & distribution overhead. The final balance of Overhead Adjustment Account is transferred to Costing Profit & Loss Account. This is, in effect, a treatment by neglect. When the amount of under-or over-absorbed overhead is too small to adopt another treatment this method is applied.

Supplementary Rate Method : When the amount of under-or over-absorbed overhead is significant distorting the product cost significantly the product cost is adjusted by applying a supplementary rate of overhead. The supplementary rate may be computed as follows :

$$\text{Supplementary Rate} = \frac{\text{Amount of under-or over-absorbed overhead}}{\text{Base element (Production Unit, Labour Hours, etc.)}}$$

The rate is applied in the same process as applied for original absorption. But this adjustment to product cost is to be carried over through all the three statuses of production. Completely produced goods may be either sold out or held in store. Production process may remain incomplete for certain units. So, supplementary rate is to be applied to proportionately adjust the cost of production involved in—

- a) Cost of Sales : for the goods already sold,
- b) Finished Goods (in store) : for unsold goods, and
- c) Work-in-progress : for semi-finished goods.

4.12 Allocation of Overhead using Activity Based Costing

Distribution of overheads on volume-based factors assumes that volume of production as measured in terms of production units, direct labour hours, etc. is the major driver of overhead cost. But this assumption does not hold good in majority of the cases particularly in a multi-product firm producing non-uniform products. As a result, volume-based allocation of overhead leads to mis-costing. To overcome the problem, an alternative method of overhead distribution based on activities that really cause overhead cost is recommended by different authors and experts. This alternative method is termed as *Activity Based Costing (ABC)*.

Under ABC, activities are treated as *cost drivers*. It may be made very clear that ABC is suggested for distribution of overhead or indirect costs only and for direct costs which are readily traceable to production units. So, activities mean activities of the centers or departments which support or provide services to production operation. These activities as cost drivers are used as bases for distribution of overhead costs. For example, machine set-up cost which is distributed by use of machine hour rate

under traditional costing, will be distributed on the basis of a rate per set-up. The cost is ultimately charged to product by multiplying the number of set-ups required for a product by the rate per set-up. Where batch production is followed the set-up cost for a batch of production will be shared equally by the production units in the batch. An illustrative list showing some activities with corresponding cost drivers is shown below (Source : Cost Accounting by B. Banerjee, p. 307) :

Activity	Cost driver
Machine set-up	Number of production runs
Purchasing materials	Number of orders placed
Warehousing	Item in stock
Material handing	Number of parts
Inspection	Inspection per item
Quality test	Hours of test time
Receiving materials	Number of receiving orders
Packing	Number of packing orders
Store delivery	Number of store deliveries
Line item ordering	Number of line items

The total cost for all the set-ups that become necessary during an accounting period constitutes a 'cost pool'. Such a cost pool is established for each identified cost driver. It is just grouping of costs having similar cause and effect relationship with the identified cost driver. The cost drivers for the activities are called transaction-based cost drivers. The underlying logic behind the replacement of volume-based cost driver as used in traditional costing by transaction-based cost driver in ABC lies in the belief that overhead costs are actually caused by the transactions handled in the support department. Thus, use of real cost-drivers for distribution of overhead more accurate allocation of overhead cost.

All the activities that are necessarily required to be performed for a complete production may be ranked into three levels :

i) *Production unit level* : There are certain activities which are required to be performed in proportion to the number of units produced. These are called unit level activities. Naturally, the costs of these activities are variable in nature.

ii) *Batch level* : There may be some activities which do not vary with the variation in the production units but vary with the number of production batches. The cost of these activities remain fixed for a batch whatever may be the production units in the batch. These are called batch level activities.

iii) *Product-sustaining level* : Activities performed to sustain or maintain a product-line come under this level. Examples of such activities include product designing, quality testing, customer satisfaction, etc.

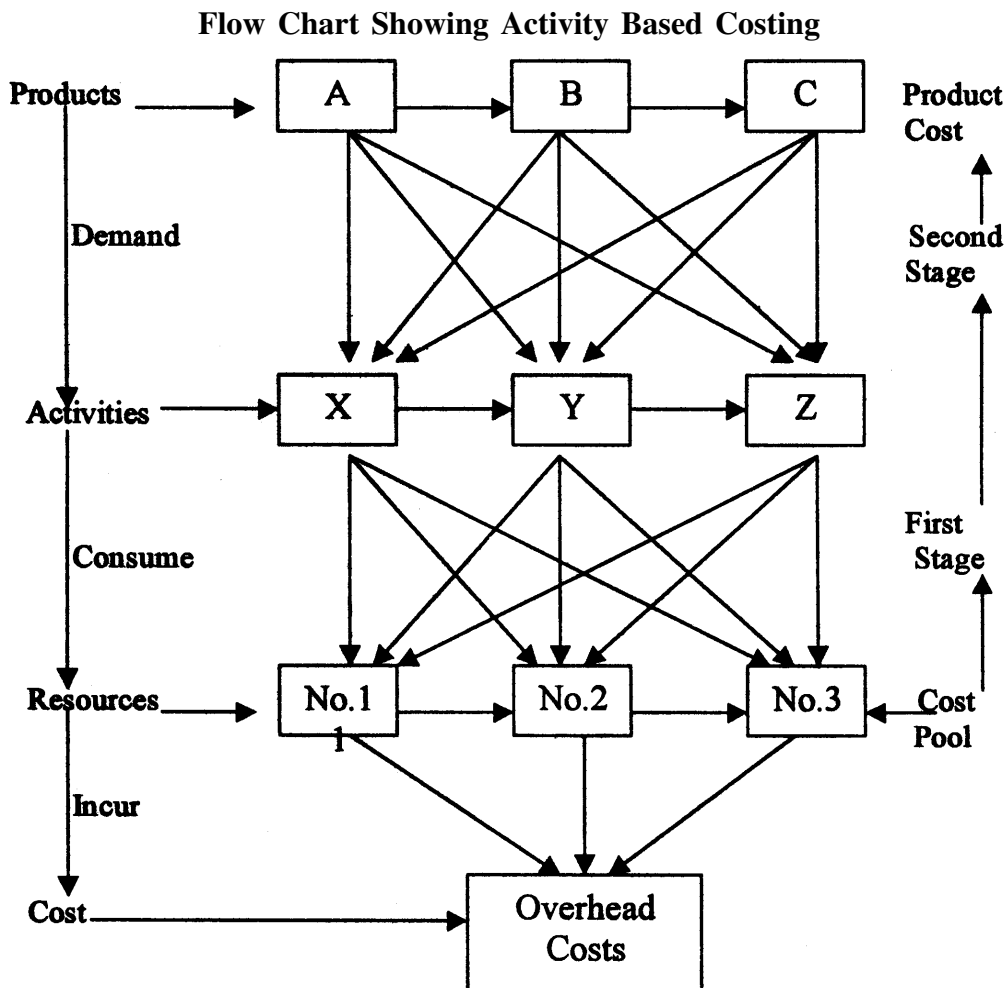
The entire process of allocation of overhead cost to cost object (i.e., product) involves apportionment at two *stages* :

i) *First stage* : The first stage of apportionment distributes cost of a cost pool to the related activities. The cost drivers used at this stage are known as *first stage cost drivers*.

ii) *Second stage* : Activity-costs are re-apportioned to cost objects by using *second stage cost drivers*.

The process of ABC is shown by a Flow Chart as shown in Figure 1.

Figure 1



4.13 Benefits of ABC

The benefits of ABC are :

i) Activities being the real cost drivers, analysis of overhead costs on the basis of activities are expected to attain more effective control on costs. The scope of combining costs of similar activities of different departments also facilitates better cost allocation.

ii) Better cost allocation with the use of activities as cost drivers leads to more accurate cost determination.

iii) Better management of activities may lead to various changes in them directed towards cost reduction.

iv) Under ABC, activities at all levels (unit level, batch level, etc.) can be separately evaluated identifying economically strong and weak activities. It helps in better decision making and better resource allocation and prioritisation of activities.

Weaknesses of ABC

Despite the above benefits, ABC suffers from certain weaknesses as mentioned below :

i) Requirement of huge data for effective implementation of ABC involves huge time, energy and cost.

ii) It fails to follow generally accepted accounting principles in some cases. For example, ABC supports distribution of some non-product overhead costs like costs of planning, general administration, building maintenance, etc. to the product cost while it does not allow allocation of some committed product cost like depreciation on factory assets.

iii) Possibility of cost reduction by change of work process is not encouraged by ABC.

iv) It fails to draw attention to the problem areas. Thus overemphasis on cost reduction overshadows the problem rather than solving them.

4.14 Questions

(a) Long answer type

1. Explain the steps involved in the process of distribution of overhead under traditional costing system.
2. What are the problems of distribution of overhead by volume-based measures? How can those problems be overcome?
3. What do you mean by under-or over-absorption of overhead? What accounting treatments are available for their disposal?

(b) Short answer type

4. Explain in brief the following terms :
 - (a) Allocation and Apportionment, (b) Pre-determination overhead rate,
 - (c) Basic process in Activity Based Costing, (d) Blanket overhead rate.
5. What factors would you take into account in choosing an appropriate overhead absorption rate?
6. What are the advantages of Activity Based Costing?

(c) Objective type

7. Mention the validity of the following statements indicating 'true' or 'false' :
 - (i) Variable overheads are direct costs.
 - (ii) The process of allotment of overhead to cost unit is known as allocation.
 - (iii) Re-appointment of service department costs to production departments is known as absorption.
 - (iv) The only reason for the under-or over-absorption of factory overhead is wrong estimation about factory overhead.
 - (v) Actual overhead absorption rate is more useful than pre-determined rate.
8. Fill in the blanks :
 - (i) Activity Based Costing can be applied only for distribution of _____ costs.
 - (ii) Superiority of Activity Based Costing lies in using _____ based cost drivers for distribution of _____.
 - (iii) A cost driver is _____ which generates cost.
 - (iv) A cost pool is a pool of costs of _____ activities of different departments.
 - (v) Unit level costs under ABC are costs of resources which vary _____ with the number of production units.

4.15 Select Readings

Banerjee, B., *Cost Accounting*, World Press Pvt. Ltd.

Hornigren, T., *Cost Accounting*, A Managerial Emphasis.

4.16 Hints for Solutions (for objectives type questions)

7. (i) to (v) False.
8. (i) indirect, (ii) transaction, overheads, (iii) an activity, (iv) similar, (v) proportionately.