

Accounting and Finance Innovations

Chapter 3

Costing Methods II: Continuous Operating Costing

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According to CIMA, Continuous operation costing is defined as the costing method applicable where goods or services result from a sequence of continuous or repetitive operations or processes. Under this method, costs are averaged over the units produced during the period, being initially charged to the operation or processes. The main focus of this definition is that continuous operation costing is to establish the average cost for unit during a specific period for a number of identical cost units.

Under this method of costing, cost per unit is calculated thus:

$$\text{Cost Per Unit} = \frac{\text{Total Cost Incurred in the Period}}{\text{Number of Units Produced in the period}}$$

The major sub-divisions continuous operations costing are:

- (i) Service Costing
- (ii) Process Costing

SERVICE COSTING

CIMA's Official Terminology defines service (or function) costing as the costing of specific services or functions: e.g. Canteens, Maintenance, Personnel, etc. These may be referred to as service centers, department or functions. Operating cost is the cost of rendering a service, therefore operating costing is the determination of the cost per unit of service rendered. It is a costing method adopted by those businesses that render services to the customers. For instance, transport both (land and air), Hotel, Canteens, Colleges/Universities, and Restaurants. Other are electricity generation, water supply, Gas supply and professionals like Accountants, Lawyers, Architects, Surveyors, etc. This method of costing may be applied by a company when its management wants determine costs of services carried out by some its departments such as canteens, medical, computer department as well as cost of vans and lorries used for distribution.

One basic difficulty usually encountered in the use of service costing is the establishment a realistic service. Cost centre (Cost Unit). Some are simple while others are composite. In a simple service cost centre we have one cost unit while in the composite are more than one, cost unit may be combined. The following represent typical service cost centers (cost unit) used in service costing.

SERVICE

POSSIBLE SERVICE COST CENTRES

Passenger Transport	Per Passenger Kilo-Meter
Good (Freight) Transport	Per Tone – Kilo-Meter
Hotel Accommodation	Occupied room-day
Hospitals	Patient-day: No. of Operations
Restaurants	Meals Served

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Electricity	Kilowatt-hour
Colleges/Universities	Full time equivalent students
Holiday Camp	Camper-day
Gas	Term
Cinema Theatre	Per man show
Water Supply	Per 100 Gallons

The issues of determination of what service cost center is most appropriate for an organization depends on what service it renders. However, whatever service cost centre that is used, the calculation of service cost centre per unit is:

$$\text{Service Cost Centre Per Unit} = \frac{\text{Total Cost Period}}{\text{No. of Service Units Supplied in the Period}}$$

Terminologies

- (i) **Service Cost Centre:** This is a cost centre or cost unit for the provision of services to other cost centres. The term service costing is applied to determine the cost of services rendered as opposed to products produced. This costing method could be applied within a organization where services are rendered by one department to others: e.g. canteen and medical departments render services to the rest of the departments.
- (ii) **Running Costs:** These are those cost of operations incurred on daily basis by the service cost centre e.g. computer ink, paper, petrol, oil etc. These types of cost are not incurred when the service is discontinued.
- (iii) **Standing (Fixed) Charges**
These categories of charges are incurred where or not are operated, e.g. security staff salaries, office rent, vehicle license, insurance, etc.

Illustration 1

Anugbuo Company Limited operated and maintained an industrial plant of its company for the year 2019 with the following cost data:

- i) Electricity consumed by plant for the year ₦17,500.
- ii) Treatment chemicals used for the plant is replaced each week at ₦2,000 per week.
- iii) Cost of maintenance amounted to ₦20,000.
- iv) Two plant attendants oversee the operation of the plant with three (3) other identical plants. Their combined wages per week is ₦20,000.
- v) General overhead costs allocated to the machine centre per year amount to ₦10,000.

Other vital information include:

- i) The original cost of the machine was ₦8 million and the plant is depreciated on a straight line basis at 10%.
- ii) The plant works effectively for 50 weeks in the year at 42 hours per week.

Required: Calculate the overhead absorption rate in the machine hours necessary to be applied to enable the company recoup the expenses incurred by the operation of the plant.

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Suggested Answer

Anugbuo Company Limited		
Cost Centre	Plant Service	
Period	One Year	
i). <u>Running 2 Operational Costs</u>	₦	
Electricity consumed	17,500	
Treatment chemical 200(50)	100,000	
Maintenance	<u>20,000</u>	
Subtotal	<u>137,500</u>	
ii) <u>Fixed/Standing Charges:</u>		
Depreciation (10% x ₦8m)	800,000	
General overheads	10,000	
Wages of workers	<u>20,000</u>	
Subtotal	<u>830,000</u>	
Total Operating Cost	907,500	

Number of hours in operation per year = 50(42) = 2100 hours

Overhead absorption rate = $\frac{967,5000 \text{ per year}}{2100 \text{ hours}}$
 = **₦460.71 per hour**

Illustration 2

Happy Returns Limited operates a haulage business with three vehicles. The following estimated cost and performance data are available.

Petrol	N0.50 per kilometer on average
Repairs	N0.30 per kilometer
Depreciation	₦1.00 per kilometer. Plus 50 per week per vehicle.

Drivers wages	₦300 per week per vehicle.
Supervision and general expenses	₦550 per week
Leading Costs	₦6 per tonne

During week 26, it is expected that all three vehicles will be used, 280 tonnes will be loaded and a total of 3,950 kilometers travelled including return journeys when embarked as shown in the following table:

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<u>Journey</u>	<u>Tonnes Carried</u> <u>(One way)</u>	<u>Kilometers</u> <u>(One way)</u>
1	34	180
2	28	265
3	40	390
4	32	115
5	26	220
6	40	280
7	29	90
8	26	100
9	<u>25</u>	<u>135</u>
	<u>280</u>	<u>1975</u>

Required:

- Calculate the average cost per tonne – kilometer for week 26.
- Briefly describe three ways a cost accounting system could aid cost control of haulage businesses.
(15 marks) (CIMA, 1996)

Suggested Solutions

(a) Calculation of Tonne Km

<u>Journey</u>	<u>Tonnes</u> <u>(One way)</u>	<u>Kilometers</u> <u>(One way)</u>	<u>Tonne</u>
1	34	180	6,120
2	28	265	7,420
3	40	390	15,600
4	32	115	3,680
5	26	220	5,720
6	40	280	19,200
7	29	90	2,610
8	26	100	2,600
9	<u>25</u>	<u>135</u>	<u>3,375</u>
	<u>280</u>	<u>1975</u>	<u>66,325</u>

Distance travelled 1,975 x 2 = 3950Km
 Calculation of Costs

N

N

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Variable Costs:

Petrol (₦0.50 x 3,950)	1,975
Repairs (₦0.30 x 3,950)	1,185
Depreciation (₦1.00 x 3,950)	3,950
Loading Costs (6.00 x 280)	<u>1,680</u>
Total Variable Costs	8,790

Fixed Costs:

Depreciation (₦0.50 x 3)	150	
Drivers Wages (₦300 x 3)	900	
Supervision and general expenses	<u>550</u>	
Total Fixed Costs		<u>1,600</u>
Total Costs		<u>10,390</u>

Average Cost per Tonne Km = 10,390

66,325 = ₦0.1567 per tonne Km

- (b) i. A system of cost accounting properly designed can provide the needed information in detail for any activity that suits best a haulage business. A cost accounting system can be designed by management to provide a particular cost data about controllable costs such as loading cost sometimes. In as much as there are costs beyond the control of management, less emphasis may be placed on such costs.
- ii. A cost accounting system should be designed by management in order to provide sufficient details about the costs of each vehicle. This implies that cheaper vehicles can be put to use first on jobs.
- iii. A cost accounting system also has the feature of providing data for target cost per tonne Km, which can enable performance to be compared.

Exercises

1. What is service costing? Enumerate the industries where this method of costing is applicable.
2. Explain the following terms below
 - (i) Running Costs
 - (ii) Service Cost Centre
 - (iii) Fixed charges
- 3(a) What are the basic purposes of service costing in a mega organization.
- (b) Is service costing different from product costing? If yes, briefly discuss.
4. Omuma Local Government Area truck makes five deliveries in a day, the tones carried and distance covered in each delivery are as follows:

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Delivery	Tonnes Carried	Distance (in Km)
1	5	50
2	6	60
3	8	80
4	10	100
5	15	180

The cost of operating that particular day was ₦6,000.00 only. Calculate the cost per tonne kilometer travelled

5. Steel Pond Wheel Limited distributes its goods to a regional dealer using a single lorry. The dealer's premises are 40 units away by road. The lorry has a capacity of 10.5 tonnes, and makes the journey twice a day full loaded on the outward journeys and empty on the return journeys. The following information is available for a 4-week budget control period 8 during 1984:

Petrol Consumption	8 miles per gallon
Petrol Cost	₦1.80 per gallon
Oil	₦8 per week
Brivcor's Wages and National Insurance	₦140 per week
Repairs	₦72 per week
Garaging (Based on 7-day week)	₦4 per day
Cost of Lorry when new (excluding tyres)	₦18,750
Life of the Lorry	80 miles
Insurance	₦650 per annum
Cost of set of tyres	₦1,250
Life of tyres	25,000 miles
Estimated sales value of lorry at end of its life	2,750
Vehicle License Cost	234 per annum
Other overheads	3,900

The Lorry operates on fixed-day week

Required:

- Prepare a statement to show the total costs of operating the vehicle in period 8, 1984 and analyzed into running costs and standing costs.
- Calculate the vehicle cost per mile and the cost per tonne/mile in the period.
- using the costs you have calculated, what could be the charge, to cover full costs, for a special delivery of 6 tonnes on outward and a return journey to a destination 120 miles away, if costs are estimated:
 - on mileage basis
 - on the basis of ton/miles carried. (20 marks) (ICMA Adapted)

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6. The following particulars refer to a process used in the treatment of material subsequently incorporated in a component of farming part of an electrical appliance:
- (a) The original cost of the machine used (purchased in June, 1984) was ₦100,000; its estimated life is 10 years; its estimated scrap value at the end of its life is ₦10,000. The estimated working time per year (50 weeks of 44 hours each) is 2200 hours of which machine maintenance etc is estimated to take up to 200 hours. No other loss of working time is expected; setting-up time which is estimated at 5% of total productive time is regarded as productive time.
 - (b) Electricity used by the machine during production is 16 units per hour at a cost of 10k per unit. No electricity is consumed during maintenance or set-up.
 - (c) The machine requires a chemical solution which is replaced at the end of each week at a cost of ₦50 each time.
 - (d) The estimated cost of maintenance per year is ₦5,500.
 - (e) Two attendants control the operation of the machine together with five (5) other identical machines. Their combined weekly wages, insurance and employer's contribution to holiday per, amount to ₦180.
 - (f) Departmental and general works overhead allocated to this for the year 1984/85 amount to ₦2,000.

You are required to calculate the machine hour rate necessary to provide for recoupment of the costs of operating the machine. Show your workings.

(17 Marks)

(ICAN, 1986)

Process Costing

Process costing is a method of costing employed where product passes through a number of distinct stages or processes before being converted to finished product. This method of costing is applied where it is not possible to identify separate unit of production, or jobs usually due to the continuous nature of the production process involved.

It is a method of costing that assigns costs to production processes where products must of a necessity be produced in, are continuous or repetitive process, with unit cost arrived at by averaging units produced to the total cost of the process. It is particularly suitable in industries where by products and residuals naturally occur.

Examples of industries where process costing could be appropriate are:

- (i) Manufacturing Industries: Paper products, cement, paint, box making, food and drinks, textiles, printing, flour mills, automobile plants, etc.
- (ii) Refining Industries: Petroleum refining, Groundnut oil refining, vegetable oil refining, Olive oil refining, etc.
- (iii) Chemical Industries: Chemicals, Pharmaceutical goods, perfumery, soap, industrial oils, baby oil, etc.
- (iv) Mining: Mineral oil, coal, gold, iron ore, Bitumen, Uranium, tin, corlumbite, zinc, etc.
- (v) Public Utility Works: Electricity generation and distribution, gas supply, water supply, etc.

The following methods below, in effect, variants of process costing:

(a) **Single (Or Output) Costing**

This is a method of costing in which cost is ascertained per unit of a single profit in a continuous manufacturing activity. Every single or per unit, the cost is calculated by dividing total production cost by units produced. As the name implies, this system is used

Accounting and Finance Innovations

where businesses supporting a product of a uniform type and the accounts show the cost of a natural unit of output, e.g. a ton of coal (in a colliery).

(b) **Operating (or Working Costing)**

As the name implies, it is given to the costing system employed by those understanding which render services rather than produce goods, e.g. railways.

(c) **Department Costing**

The name is often, adopted for those accounting system in which the cost of operating a department of a business or the cost of products emanating from a department is determined. This is usually applied to the system adopted by retail departmental stores.

Features of Process Costing

- i) The production continuous.
- ii) The product is homogeneous.
- iii) The process is standardized.
- iv) The output of one process becomes the raw material of another process.
- v) The output of the last process is transferred to finished stock.
- vi) Costs are collected process – wise.
- vii) The sequence of operations for processing the product is predetermined.
- viii) There is always a loss in the process due to spoilage, wastage, evaporation, etc.
- ix) Output from production may be single product, but there many also be by- products or joint products.
- x) Costs are accumulated by processes.
- xi) Each process is distinct and is pre-determine.
- xii) It is not possible to distinguish finished products while they are in the stage of processing.
- xiii) The finished product is the result of two or more processes.

Objectives of Process Costing

- 1. To determine unit cost of a process.
- 2. To determine the method of allocation of manufacturing cost incurred during a given period.
- 3. To allocate the accumulated materials, labor and factory overheads costs to process centers.
- 4. To express incomplete units in terms of completed units (equivalent units computation)
- 5. To give accounting treatment to process losses such as wastes, scraps, defective goods and spoiled goods.
- 6. To differentiate the main product from by-product and joint product.
- 7. To give accounting treatment to joint products and by-product.
- 8. To calculate the cost of main product accurately.

Terminologies Associated with Process Costing

- 1. **Normal Loss:** A normal loss is an unavoidable loss in production process either evaporation, inspection of qualities, etc. A predetermine percentage is usually allowed for such losses and its cost is borne by good product. This is usually credited to process account.

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2. **Abnormal Loss:** These are losses which cannot be foreseen, e.g. the use of materials which is deficient in quality. Such losses are transferred out of the process at the average cost and charged to the income statement (profit or loss account).
3. **Abnormal Gain:** This is an output in excess of the expected output. It is normally recognized in the process accounting in the way same as normal input. Abnormal gain (a benefit) is usually in the process account.
4. **Scrap:** These are losses in a production process with some recovery value even though relatively minor. They represent part of the raw material no longer required either because they are out of date (expired) or they are useless as a result of process. The value of a normal scrap is deducted from the input cost. However, scrap value is the net realizable value of a scrap after consideration of the cost of conversion of such wastages if any.
5. **Waste:** These are those aspects of the raw materials with very low or no measurable recovery value. They are losses in production process. They are also referred to as discarded substance having no value.
6. **Defective Units:** These are units of production that do not meet quality standard and therefore are reworked.
7. **Spoilage Units:** These are those production units that do not meet quality standard and therefore sold off.
8. **Joint Product:** These are products jointly produced in a production process. They usually attract joint cost. They are two or more products that are generated within a single production process. Meaning that they cannot be produced separately and undifferentiated joint costs.

Joint products cannot be separated until a specific split point or separation point. From this point onwards, the two products can be produced individually. Joint products have substantial sales value (or a substantial sales value after further separation process). Examples of joint products include:-

- (i) Milk – butter, cream, cheese
- (ii) Crude oil – fuel, gas, kerosene

9. **By Product:** The CIMA definition for byproduct is output of source value produced incidentally in manufacturing something else (main product). There are individual outputs of a manufacturing process normally regarded as having no cost before separation point but cost after separation point. A byproduct is a product which is similarly produced at the same time and from the same common process as the main product or joint products. The distinguishing feature of a byproduct is its relatively low sales value in comparison to main product.

A byproduct is not important as a saleable good (item), therefore whatever revenue it earns is considered a bonus. It is also not worth the trouble of matching costs with revenue of byproducts because of their relative insignificance in the organization concerned. The accounting treatment by a byproduct is to deduct from the cost of production of the main product the net realizable value of byproduct.

Work-in-Progress: Work-in-progress, also known as work-in-process, these are items of production that are still in the process of transformation to finished goods. It can be thought of as inventory that is still on the Factory Floor. Meaning that manufacturing of the goods has started but has not yet been completed, hence, cannot be categorized as inventory or finished goods. Work-in-progress inventory is the middle stage of the production process between raw

Accounting and Finance Innovations

materials and finished product. It is accounted for as an asset on a company's statement of financial position (Balance Sheet).

Equivalent Units: Equivalent units of production is a term applied to the work-in-progress inventory at the end of accounting period. It is an expression of the amount of work done by a manufacturer on units of output that are partially completed at the end of an accounting period. Equivalent unit measures are necessary since all the physical units are not completed to the same extent at the same.

Equivalent units are calculated by multiplying the number of physical (or actual) units on hand by the percentage of completion of units. For example, if there are 300 incomplete units in a process at the end of a period and are 75% complete, then this is equivalent to 225 ($.75 \times 300$) whole (complete) units. Simply put, equivalent production represents the production of a process in terms of completed. It means converting uncompleted production into its equivalent of completed units.

Differences between Job Costing and Process Costing

The differences between job costing and process costing are tabulated thus:

Job Costing	Process Costing
1. Job is undertaken to customers' specific requirements.	Production is continuous, done in anticipation of demand.
2. Job work completed is independent of each other.	Production is continuous, hence identify of products is not possible.
3. Job costing is used for unique products.	Process costing is used for standardized products.
4. Job costing is used very small production runs	Process costing is used for large production runs
5. Much more record keeping is required for job costing since time and materials must be charged to specific jobs.	Process costing aggregates costs, and so requires less, record keeping.
6. Job costing accumulated costs by individual jobs.	Process costing accumulated costs by process or departments.
7. Job cost systems have one process inventory account for each job.	Process cost systems have a work in process inventory account for each department or process.
8. Job costing is suitable for industries which manufacture products as per customer's order.	Process costing is perfect for the industry where mass production is done.
9. Work in progress may or not exist at the beginning and at the end of the financial year.	Work in progress is always present in the beginning or at the end of the accounting period.
10. In job costing, the cost centre is the job itself.	In process costing, the cost centre is the process itself.
11. In job costing each job requires special treatment.	No special treatment is required for each process in process costing.
12. There is no transfer of cost in job costing from one job to another.	The cost of the last process is transferred to the next process in the process costing

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Difficulties Encountered in the Operating Process Costing: They are

1. Cost cannot be directly identified with the cost unit and so costs are collected by process over the units produced in that particular period.
2. Losses usually occur in most processes and difficulties are usually encountered in estimating the amount of loss that can be normally expected.
3. Accounting for scraps and waste often poses source difficulties.
4. Valuation of work-in-progress at the end of a period usually requires estimates to be made of the degree of completion in terms of the estimates of cost.
5. Where the process results in the production of by-products difficulty is also encountered in the accounting treatment of the cost/proceeds of the by-products.

Illustration 1

Nwugha Integrated Services has a plant that processes a product through three distinct processes A, B & C. To complete the production during the period, 1,000 litres of a particular liquid substance.

The following information is obtained:

Process	A	B	C
Material Cost	₦3,500	20,000	10,000
Labour Cost	₦20,000	20,000	20,000
Direct Overhead Cost	₦1,000	8,000	5,000

Indirect overhead expenses for the period was ₦30,000 apportioned to the processes on the basis of wages. There was no work in-progress at the commencement and end of the period.

Required:

Calculate the cost of the output to be transferred to the finished goods account and the cost per unit of each process.

Suggested Solution

Process A Account

Particulars	Units	CPU	Amount	Particulars	Units	CPU	Amount
Material Input	1,000	35	35,000	Transferred to Process B		75	75,000
Labour Cost		20	20,000				
Direct Overhead Expenses		10	10,000				
Indirect Expenses		10	10,000				
Total		75,	75,000			75	75,000

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Process B Account

Particulars	Units	CPU	Amount	Particulars	Units	CPU	Amount
Process A		75	75,000	Transferred to Process C Account		133	133,000
Materials Cost		20	20,000				
Labour Cost		20	20,000				
Direct Overhead Exp.		8	8,000				
Indirect Expenses		10	10,000				
Total		133	133,000			133	133,000

Process C Account

Particulars	Units	CPU	Amount	Particulars	Units	CPU	Amount
Process B		133	133,000	Transferred to Finished Goods Account		168	168,000
Materials Cost		10	10,000				
Labour Cost		20	20,000				
Direct Overhead Exp.		5	5,000				
Total		168	168,000			168	168,000

Finished Goods Account

Particulars	Units	CPU	Amount	Particulars	Units	CPU	Amount
Output from Process C	-	168	168,000				

Workings

Calculation of Indirect Expenses

$$\text{Process A} = \frac{20,000}{60,000} \times \frac{\text{₦}30,000}{1} = \text{₦}10,000$$

$$\text{Process B} = \frac{20,000}{60,000} \times \frac{\text{₦}30,000}{1} = \text{₦}10,000$$

$$\text{Process A} = \frac{20,000}{60,000} \times \frac{\text{₦}30,000}{1} = \text{₦}10,000$$

Illustration 2

Nkwoji Integrated Services received an order 5,000 sets of dining tables from Government Comprehensive College, Borokiri, Port Harcourt. Production of the order requires three (3) sequential processes: Cutting, Assembling and Finishing Direct Cost for each process are as follows:

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	Cutting ₦	Assembling ₦	Finishing ₦
Raw Materials	6,610	2,610	3,500
Direct Labor	2,755	2,090	2,500
Indirect Expenses	1,655	1,020	2,060
Other Overheads	<u>6,750</u>	<u>8,950</u>	<u>4,780</u>
	17,770	14,670	12,840
Output (Units)	5,500	5,200	5,000

The normal loss expected for each process is 5% of input. Raw materials input into the cutting process is equivalent to 5,800 units assuming no losses of any type. All materials are introduced at the beginning of the relevant process and there are no stocks or work-in-progress at the start and end of each process.

You are **required** to record the transactions in the accounts for each process.

Suggested Solution

Nkwoji Integrated Services Cutting Process Account

Particulars	Qty	Price	Amount	Particulars	Qty	Price	Amount
Materials Input	5,800		6,610	Normal Loss (5% of 5,800)	290	-	-
Direct Labour			2,755	Output to Assembling Process A/C	5,500	3,255	17,738
Direct Expenses			1,655	Abnormal Loss	10	3,255	32
Other Overheads			6,750				
Total	5,800		17,770		5800		17,770

Assembling Process Account

Particulars	Qty	Price	Amount	Particulars	Qty	Price	Amount
Transfer from Assembling Process A/C	5,200		32,253	Normal Loss (5% of 5,200)	260	-	-
Material Input			3,500	Output to Finished goods A/C	5,000	91.281	45,640
Director Labour			2,500	Balancing Figure			1
Direct Expenses			2,060				
Other Overheads			4,780				
Abnormal Gain	60	91.281	548				
Total	5,260		45,641		5,260		45,641

Accounting and Finance Innovations

Workings

Formula = $\frac{\text{Actual Cost} - \text{Scrap Value}}{\text{Expected Output}}$ = Cost Per Unit

- (a) Cutting Process = $\frac{17770}{5510}$ = ₦3.225
- (b) Assembling Process = $\frac{32408}{5225}$ = ₦6.205
- (c) Finishing Process = $\frac{45095}{4940}$ = ₦9.1281

Illustration 3

Bomakay Ltd. Produces Rax tablet soap which passes three(3) processes. The costs of production for the year ended 31 December, 2016 were as follows:

	Processes			
	Total	1	2	3
	₦	₦	₦	₦
Direct Materials	15,000	5,000	7,000	3,000
Direct Labour	24,000	6,000	10,000	8,000
Direct Expenses	8,000	3,000	2,500	2,500
Other Expenses	1,500	500	-	1,000
Production Overhead	15,160	6,600	4,860	3,700

- (ii) 5,000 Units at ₦3 per unit were issued to process 1 and the outputs of each process were as follows:
- | | | |
|-----------|---|-------------|
| Processes | 1 | 4,800 Units |
| | 2 | 4,000 Units |
| | 3 | 3,900 Units |

- (iii) Loss in each process should be regarded as scrap and be sold at a price of ₦2 each.

Required: Prepare

- (a) Process for each of the process
- (b) Abnormal Loss and Abnormal gain accounts (ICAN/ATS Adapted)

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Suggested Solution

Bomakay Ltd. Process 1 Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Raw Material	5000	3	15,000	Normal Loss	500	2	1,000
Direct Material			5,000	Output to process 2	4,800	7.8	37,440
Direct Labour			6,000				
Other Expenses			3,000				
			500				
Production Overhead			6,600				
Abnormal Gain	300	7.8	2,340				
Total	5,300		38,440		5,300		38,440

$$\text{Cost Per Unit} = \frac{36100 - 1000}{5000 - 500} = \frac{35100}{4500} = \underline{\underline{₦7.80}}$$

Process 2 Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Input from Process 1	4,800	7.8	37,440	Normal Loss	300	2	600
Direct Material			7,000	Output to Process 3	4,000	13.6	54,400
Direct Labour			10,000	Abnormal Loss	500	13.6	6,800
Direct Expenses			2,500				
Production Overhead			4,860				
Total	4,800		61,000		4,800		61,800

$$\text{Cost Per Unit} = \frac{61,800 - 600}{4,800 - 300} = \frac{61,200}{4500} = \underline{\underline{₦13.6}}$$

Process 3 Amount

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Input from Process 2	4,000	13.6	54,400	Normal Loss	200	2	400
Direct Material			3,000	Output transferred to Finished Goods A/C	3,900	19	74,100
Direct Labour			8,000				
Direct Expenses			2,500				
Other Expenses			1,000				
Production Overhead			3,700				
Abnormal Gain	100	19	1,900				
Total	4,100		74,500		4,100		74,500

$$\text{Cost Per Unit} = \frac{72,600 - 400}{4,800 - 200} = \frac{72,200}{3,800} = \underline{\underline{₦19.00}}$$

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(b) Abnormal Gain Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Scrap A/C	400	2	800	Process 1 A/C	300	7.8	2,340
Income Statement			3,440	Process A/C	100	19	1900
	400		4,240		400		4,240

Abnormal Loss Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Process 2 A/C	500	13.6	800	Scrap A/C	500	2	1,000
			3,440	Income Statement			5,800
	500		6,800		500		6,800

Valuation of Work-In-Progress

This process is used to value Work-In-Progress (WIP) for inventory valuation in cost Accounting. The Work-In-Progress value is calculated for all open manufacturing orders and works orders.

Equivalent Production

CIMA defines Equivalent Units as a "notional quantity of completed units substituted for an actual quantity of incomplete physical units in progress, when the aggregate work content of the incomplete units is declared to be equivalent to that of the substituted units, e.g., 150 50 percent complete (50 x 150 Units) = 75% equivalent units.

The production is continuous; there is always work-in-progress at the end of an accounting period which is always carried to the next accounting period. A basic problem with work-in-progress in a process costing is the difficulty in ascertaining the cost of each completed products, hence the application of equivalent production concept unit costs of each element of cost. Equivalent production represents the production of a process in terms completed units. The valuations of work-in-progress during production process the following five (5) steps.

1. Trace physical units into equivalent units.
2. Convert physical units into equivalent units.
3. Ascertain for each element of cost.
4. Ascertain the cost per unit each equivalent unit.
5. Prepare a statement of valuation for the various items of output.

Illustration 4

Achonwa Company Ltd., manufactured a light liquid fertiliser which passes chemicals through two consecutive processes. Stores record cards for the chemical ingredients used exclusively by the first process shows the following data for September, 2019.

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		₦
Opening Stock	4,000 Litres	10,800
Closing Stock	8,000 Litres	24,200
Receipts into Stock	20,,000 Litres	61,000

Other process data for the months is tabulated below:

	Process 1	Process 2
		₦
Direct Labor	₦4,880	6,000
Direct Expenses	₦4,270	Nil
Overhead Absorption Rate (as percentage of direct labour)	25%	150%
Output	8000 Litres	7500 Litres
Opening WIP	Nil	Nil
Closing WIP	5600 Litres	Nil
Normal Yield	85% of input	90% of input
Scrap Value	Nil	Nil

In process 1 the closing stock of work in progress has just passed through inspection, which is the stage where materials and conversion costs are 100% and 75% complete respectively. However, in process 2 inspection is the final operation.

Require

Prepare the relevant accounts to show the results of the process for September 2019 and present a detailed working paper showing your calculations.

Suggested Solution

Process 1 Account for September, 2019

Particulars	Litres	Price ₦	Amount	Particulars	Litres	Price ₦	Amount
National Input (WKS)	16,000		47,600	Normal Loss (15% of 16,000)	2,400	-	-
Direct Labour			4,880	Output to process 2	8,000		42,000
Direct Expenses			4,270	Closing WP	5,600		26,950
Overhead (250% of 4880)			12,200				
Total	16,000		68,950		16,000		68,950

Process 2 Account for September, 2019

Particulars	Litres	Price ₦	Amount	Particulars	Litres	Price ₦	Amount
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Accounting and Finance Innovations

Transfer Process 1	8,000	5.25	42,000	Normal Loss (15% of 8,000)	800	-	-
Direct Labour			6,000	Output	7,500	7.5	56,250
Overhead (100% of 6,000)			<u>6,000</u>				
Abnormal Gain	<u>300</u>	7.5	<u>54,000</u>				
			<u>2,250</u>				
Total	<u>8,300</u>		<u>26,250</u>		<u>8,300</u>		<u>56,250</u>

$$\text{Cost Per Unit of Litre} = \frac{\text{Cost} - \text{Scrap Value}}{\text{Expected Output} - \text{Normal Loss}} = \frac{54,000 - 0}{7,200} = \text{N}7.5$$

Conversion to Equivalent Charts

Particulars	Physical Units	Materials		Labour		Direct Expenses		Overhead	
		%	E U	%	E U	%	E U	%	E U
Normal Loss	2,400	-	-	-	-	-	-	-	-
Output	8,000	100	8,000	100	8,000	100	8,000	100	8,000
Closing WIP	<u>5,600</u>	<u>100</u>	<u>5,600</u>	<u>75</u>	<u>4,200</u>	<u>75</u>	<u>4,200</u>	<u>75</u>	<u>4,200</u>
	<u>1,600</u>		<u>13,600</u>		<u>12,200</u>		<u>12,200</u>		<u>12,200</u>

$$\text{Cost Per Unit} = \begin{array}{llll} \frac{47,600}{13,600} & \frac{4,880}{12,200} & \frac{4,270}{12,200} & \frac{12,200}{12,200} \\ \text{N}3.50 & \text{N}0.4 & \text{N}0.35 & \text{N}1.00 \end{array}$$

$$\text{Valuation of Output} = 8,000 \times \text{N}5.25 = \text{N}42,000$$

Valuation of Work – In – Progress

		N
Material	5600 x N3.50	19,600
Direct Labour	4200 x N0.40	1,680
Direct Expenses	4200 x N0.35	1,470
Overhead	4200 x N1.00	<u>4,200</u>
		<u>26,950</u>

Working

Raw Material Stock Account

Particulars	Units	Amount	Particulars	Units	Amount
Opening Stock	4,000	10,800	Issues to Process 1	16,000	47,600
Purchases	<u>20,000</u>	<u>61,000</u>	Closing WIP	<u>8,000</u>	<u>24,200</u>
	<u>24,000</u>	<u>71,800</u>		<u>24,000</u>	<u>71,800</u>

Illustrations

Nwangaga Company Ltd. has three (3) joint products produced by passing a chemical process through two consecutive processes. Output from the first process is transferred into the second process, from which the three joint products are produced and immediately sold.

The previous month's operating data for the processes is tabulated below:

Accounting and Finance Innovations

Processes

There were no opening or closing stocks in either process and the selling price of output from

	1 ₦	2 ₦
Direct Material (25000 kilos @ 4 per Kilo)	100,000	-
Direct Labor	62,500	69,000
Overheads	45,000	67,000
Normal Loss	10% of input	Nil
Scrap Value of Loss	₦2 Per Kilo	-
Output	23,000 Kilos	
Joint Products		
A	9000 Kilos	
B	8000 Kilos	
C	6000 Kilos	

process 2 were:

Joint Products	A	₦24 Per Kilos
	B	₦18 Per Kilos
	C	₦12 Per Kilos

You are Required:

- (i) Prepare an account for process 1, together with any loss or gain accounts you consider necessary to record the month's activities;
- (ii) Calculate the profit attributable to each of the joint products by apportioning total costs from process 2:
- (a) According to weight of output
- (b) By the market value of production

Suggested Solution

Nwangaga Company Ltd. Process 1 Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Material Input	25,000	4	100,000	Normal Loss (10%)	2,500	2	5,000
Direct Labour			62,500	Output	2,300	9	20,700
Overhead			45,000				
Abnormal Gain	500	9	45,000				
	25,500		212,000		25,500		212,000

$$\text{Cost Per Unit} = \frac{\text{Cost} - \text{Scrap Value}}{\text{Input} - \text{N Loss}} = \frac{207,500 - 500}{25,000 - 2,500} = \frac{202,500}{22,500} = \underline{\underline{₦9.00}}$$

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Process 2 Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Process 2	23,000	9	207,000	Normal Loss (10%)	-	-	-
Direct Labour			69,000	Joint Products			
Overhead			67,000	A	9,000	14.91	134,190
				B	8,000	14.91	119,280
				C	6,000	14.91	89,460
	<u>23,000</u>		<u>343,000</u>		<u>23,000</u>		<u>343,000</u>

$$\text{Cost Per Unit} = \frac{\text{N}343,000}{23,000\text{kg}} = \text{N}14.91$$

Process Scrap Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Normal Loss From Process	<u>2,500</u>	2	<u>5,000</u>	Abnormal Gain	500	2	1,000
	<u>2,500</u>		<u>5,000</u>	Cash	2,000		<u>4,000</u>
					<u>2,500</u>		<u>5,000</u>

Abnormal Gain Account

Particulars	Qty	Price ₦	Amount	Particulars	Qty	Price ₦	Amount
Scrap Account	500	2	1,000	Process 1	500	9	4,500
Income Statement (P & L)			3,500	Abnormal Gain			
	<u>500</u>		<u>4,500</u>		<u>500</u>		<u>4,500</u>

(ii) Profit Attributable Using Weight of output

Joint Production	Output	Sharing N Value	Amount
A	9,000	9/23 x 343,000	134,217
B	8,000	8/23 x 343,000	119,304
C	6,000	6/23 x 343,000	89,978

Accounting and Finance Innovations

Products	Statement of Profit Attribute		
	A	B	C
Output (Qty)	9,000	8,000	6,000
	₦	₦	₦
Sales	216,000	144,000	72,000
Joint Cost	(134,217)	(119,304)	(89,478)
	<u>81,783</u>	<u>24,696</u>	<u>(17,478)</u>
Grand Total	<u>₦89,001.00</u>		

Profit Attributable Using Market Value

Products	Output	SP ₦	Sales Value ₦	Sharing ₦ Value	Amount
A	9,000	24	216,000	216/432 x 343,000	171,500
B	8,000	18	144,000	144/432 x 343,000	114,333
C	6,000	12	<u>72,000</u>	72/432 x 343,000	<u>57,166</u>
			<u>432,000</u>		<u>343,000</u>

Products	Statement of Profit Attributable		
	A	B	C
Output (Qty)	9,000	8,000	6,000
	₦	₦	₦
Sales	216,000	144,000	72,000
Joint Cost	(171,500)	(114,333)	(57,166)
	<u>44,500</u>	<u>29,667</u>	<u>(14,834)</u>
Grand Total	<u>₦89,001.00</u>		

Revision Exercise

- What do you understand by the terms Normal Process Loss, Abnormal Process Loss and Abnormal Process Gain?
- What are the features of process costing?
- Distinguish Job costing from process costing?
- Write Short notes on the following terms:
 - Abnormal Process Gain
 - Joint Products
 - By Products
 - Equivalent Units
- What are Joint Products? List the methods that could be employed in the costing of Joint Products.
- Distinguish Joint Products from By Products.

Accounting and Finance Innovations

7. What do you understand by (a) normal and (b) abnormal loss in the process of production? State briefly how each is treated in the process cost accounts.
 8. What do you understand by equivalent production? Briefly discuss its relevance in valuing work-in-progress.
 9. What is process costing? In what type of industries is process costing generally applied?
 10. Manugba is a manufacturer of a substance K. It runs a process operation and, as might be expected uses process costing to account for it.
Substance K is made in one process. Usually 10Kg of material Q is required for the process. However, normally 8Kg of substance K is produced. In period 1, Manugba's input of 10Kg of material Q, at ₦8 per Kg, to the process. Only 8.5Kg of K was produced. In period 2, Manugba input of 10Kg of material Q at ₦8 per Kg to the process, and found that 9.5Kg of K was produced.
- Required:** Prepare the process accounts for periods 1 and 2
11. Nwangbo Company Ltd. Using costing to manufacture a single product which passes through consecutive processes, the output of process 1 becoming the input to process 2: Normal losses and abnormal losses are considered defective units having a scrap value and cash received at the end of the period for all such units.

The following information relates to the four-week period of accounting period. Raw materials issued to process 1 was 3,000 units at a cost of ₦5 per unit. There was no opening or closing work in progress but opening and closing stocks of finished goods were ₦20,000 and ₦23,000 respectively.

Process	1	2
Normal loss as a percentage of input	10%	5%
Output in Units	2,900	2,700
Scrap Value per Unit	₦2	₦4
Additional Components	₦1,000	₦780
Direct Labour Cost incurred	₦4,000	₦6,000
Direct Expenses incurred	₦10,000	₦14,000
Production Overhead as a Percentage of direct Labor cost incurred	75%	120%

Required: Prepare the following accounts:

- (a) Processes 1 and 2
- (b) Finished Goods
- (c) Normal Loss and abnormal Loss
- (d) Abnormal Gain
- (e) Income statement extracts

Accounting and Finance Innovations

12. Nwubani Enterprises Operates a process, the details of which for the period were as follows.

There was no opening work-in-progress.

During the period 8,250 units were received from the previous process at a value of ₦453,750, labour and overheads were ₦350,060 and material introduced was ₦24,750.

After the end of the period, the closing work –in – progress was 1,600 units, which were 100% complete in respect of materials, and 60% in respect of labour and overheads. The balance of the units were transferred to finished goods.

Required:

- (a) Calculate the member of equivalent units produced.
- (b) Calculate the cost per equivalent units.
- (c) Prepare the process account.
- (d) Distinguish between joint products and by-products, and briefly explain the difference in accounting treatment between them.

(15 Marks)

(CIMA Adapted)

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