ENGINEERING ECONOMY

SME4833

Chapter 4
COST ACCOUNTING

Lecturer

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Cost Accounting

Learning outcome:

After this chapter students should be able to :

1. Explain basic terminology in cost accounting.
2. Able to charge overhead cost to product.
3. Able to assign cost to service centers.
4. Able to conduct marginal costing and absorption costing.
5. Able to assign cost in product sharing.
7. Able to conduct Activity Based Costing.

COST ACCOUNTING

4.1 Introduction

4.2 Method of Determining Cost of Products

4.3 Allocating Overhead Costs of Service Centers

4.4 Absorption Costing and Marginal Costing

4.5 Activity Based Costing

4.6 Chapter Summary

Materials in these slides are extracted from a published text. Readers who are interested to get detail explanation can refer to the following text:

Muhamad Zameri Mat Saman, Wan Harun Wan Harun Wan Hamid, Masine Md Tap, Rozlina Md Sirat. *Engineering Economy and Accounting for Engineers, Pearson Malaysia Sdn. Bhd., Malaysia, 2012.*

4.1 Introduction

- Definition of cost accounting

  Measures, analyzes, and report financial and non financial information relating to the cost of acquiring or using resources in an organization.

- Cost ascertainment
  - Determining cost to produce a unit product or an operation or a task.

- Historical data is required for analysis and report.

- Relevant past data may be used as a guide in estimating future cost and income.

Basic terminologies in cost accounting

- Cost = Total spending/ payment for something .
  / = Resource (Example : finance, information)
  = money
- It is charged to unit cost, that is, cost per unit of the item/product produced.
- Cost can be classified in many ways. The main classification is direct cost and indirect cost.

Direct Cost

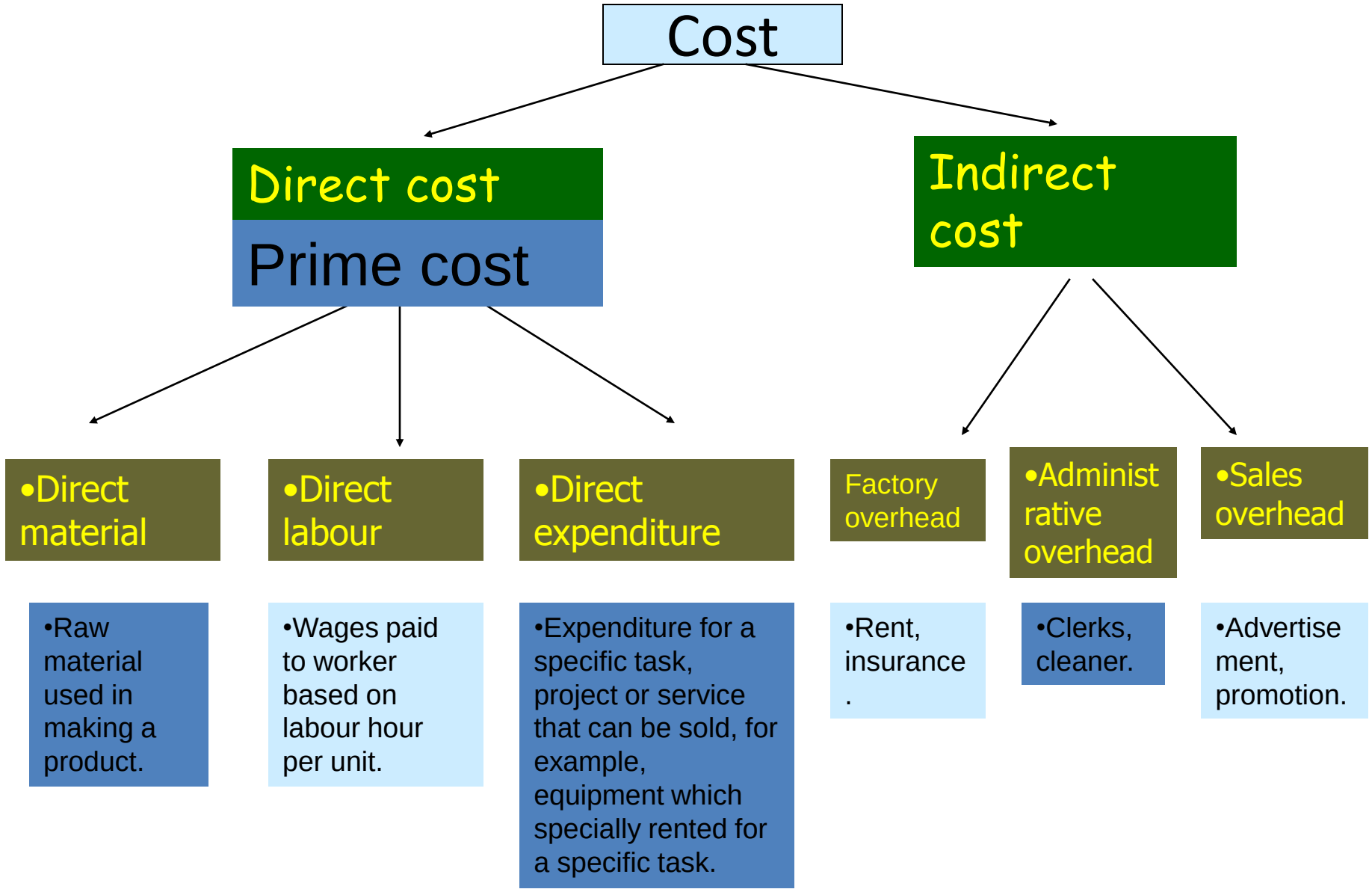
- Cost that can be traced directly to a task, product or service, such as;
  - Direct material cost – example : raw material to produced a product.
  - Direct labour cost – example: workers' wages or pay to produce a product or service.
  - Direct expenditure cost – example: specific expenditure for a task/job, project or service.
- Prime cost = Σ direct cost

  = Direct material cost + Direct labour cost

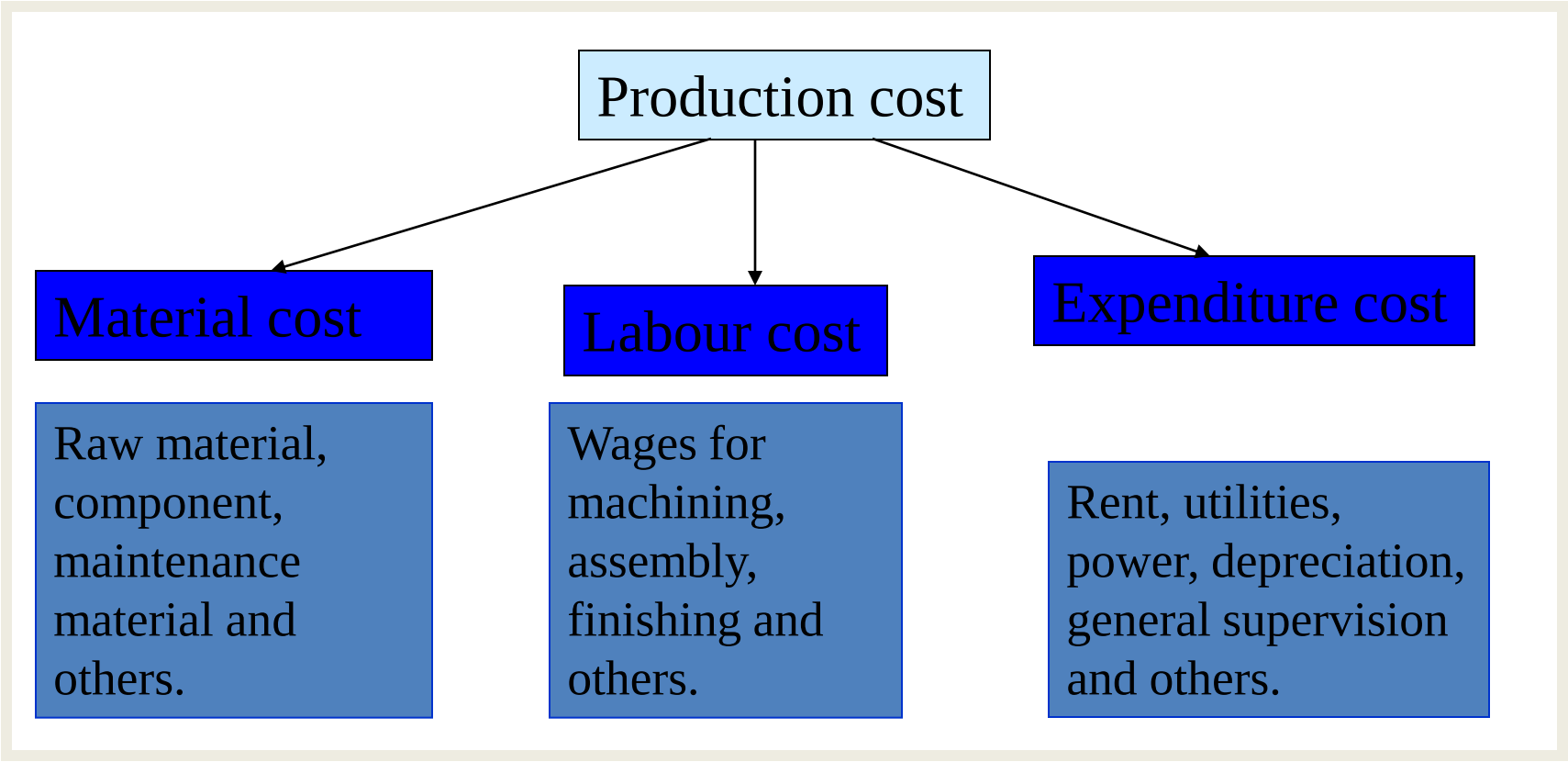
  + Direct expenditure cost

Indirect cost

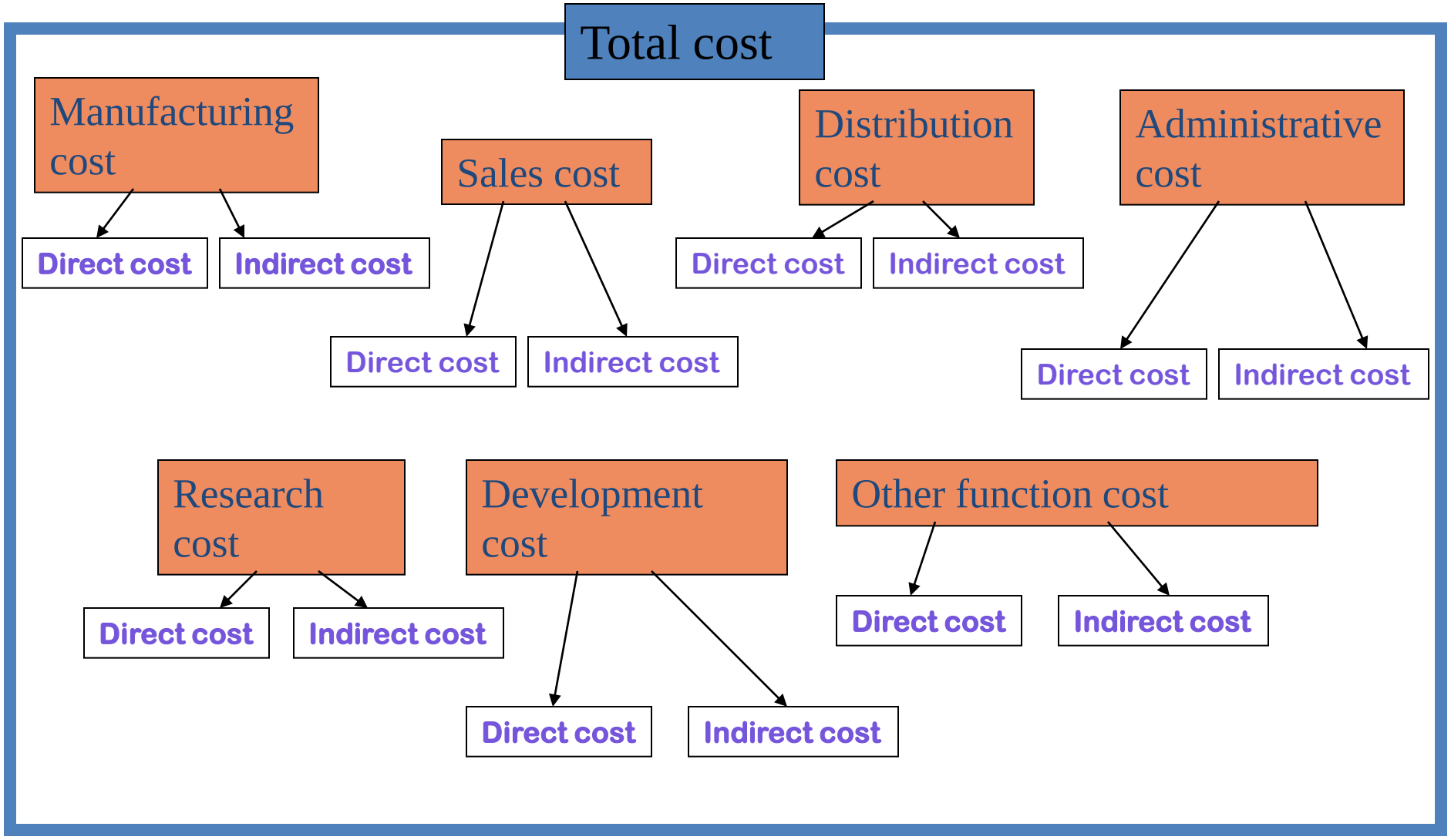
- Cost which cannot be directly traced to a product or service. (example: water, electricity, depreciation)
- Also called overhead (Example : factory overhead, administrative overhead, sales overhead and others)


Cost
Direct cost
Prime cost
Indirect cost
•Direct material
•Direct labour
•Direct expenditure
Factory overhead
•Administrative overhead
•Sales overhead
•Raw material used in making a product.
•Wages paid to worker based on labour hour per unit.
•Expenditure for a specific task, project or service that can be sold, for example, equipment which specially rented for a specific task.
•Rent, insurance .
•Clerks, cleaner.
•Advertisement, promotion.

Cost classification according to form



Classification based on function



Period cost

- Cost of all products that were sold and all expenditure that occurred in a specific financial period.
- Example : Cost of sale, wages, water and electricity, insurance and depreciation of fixed asset.
- Only these costs may be transferred to the income statement for that period to calculate profit.

- Relevant cost

  Cost that has to be considered in decision making.

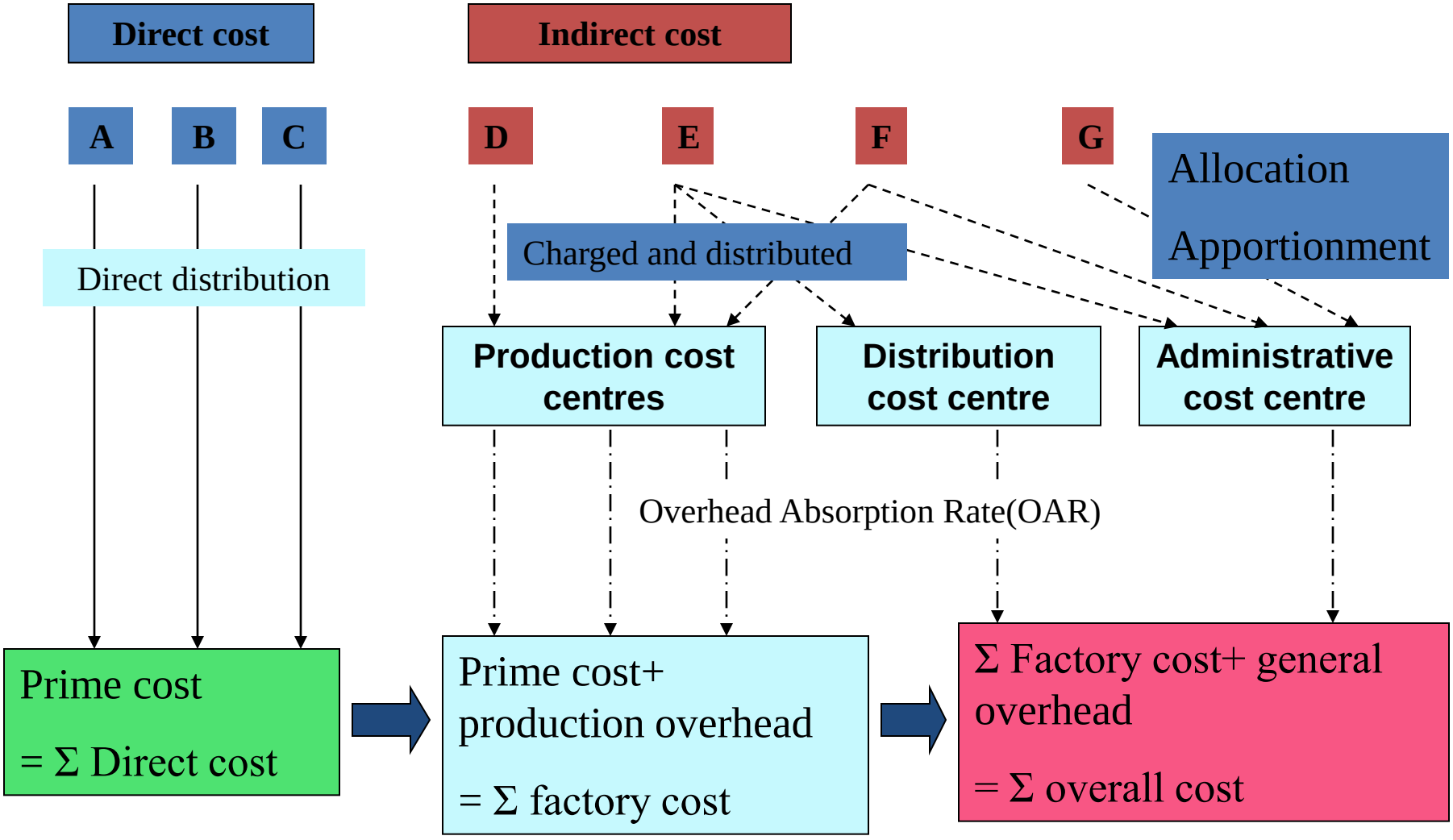
- Opportunity cost

  Cost of lost opportunity because a choice was made on one alternative.

4.2 Method for Determining Cost of a Product

- Types of cost :
  - Material – direct cost
  - Labour – direct labour
  - Overhead – all production cost except direct material cost, direct labour cost and direct expenditure cost.

Method for determining product cost



Material cost

- Also include purchase, delivery, storage aspects and other financial function aspects.
- 4 types of system that are usually used to determine material cost:
  - FIFO (First In First Out) – inventory price is based on the earliest stock.
  - LIFO (Last In First Out) – inventory price is based on the latest stock.
  - Average – An average with weightage system. Cost is between FIFO and LIFO
  - Standard price – price is determined based on consideration of all factors that affect the material price.

Labour cost

- Labour cost is difficult to determine because of the complicated wage system.
- Systems that may be used :
  - Based on volume or production quantity (variable cost in RM/hour or RM/unit)
  - Fixed wages.

Overhead

Include all indirect production costs. Do not include direct material, direct labour and expenditure costs.

Collect all overhead (resource cost)

First step

Assign to cost centers

Second step

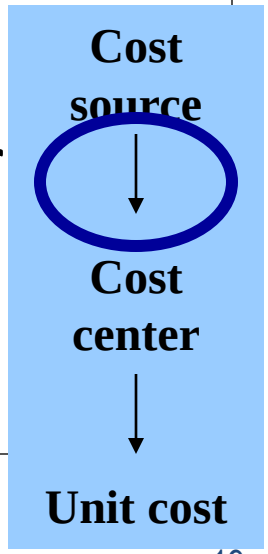
Absorb cost from all cost centers to unit production.

- Cost centers = a production or service, function or equipment location where costs can be allocated to unit cost.
- Example : Production cost center, administration cost center, distribution cost center.
- Two methods to distribute overhead to cost centers:
  - Cost allocation (Peruntukan kos)
  - Cost apportionment (Penguntukkan kos)

First step

Cost Allocation

- The transfer of all overhead cost to a cost center.
- Used only when overhead is utilised by a cost center.
- Example : fuel used only by boiler center.



Cost apportionment

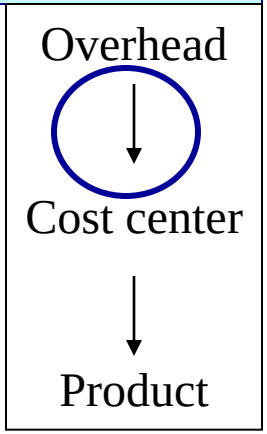
First step

- The transfer of overhead from cost source to cost centers.
- Basic example of cost apportionment :

Overhead	Basis of apportionment
Building – rent, cleaning and depreciation.	**Floor space.**
Officers' wages, canteen cost, benefit cost, human resource management and security.	**Number of workers.**
Power.	**Machine's motor power.**
Storage cost.	**Percentage of warehouse utilization .**
Storage and material handling cost.	**Weight / volume of raw material.**

Example1: Overhead Apportionment

Machine depreciation	RM15,000	Housekeeping	RM10,400
Rent	RM20,800	General monitoring	RM12,000
Utilities	RM7,800	Boiler	9,000



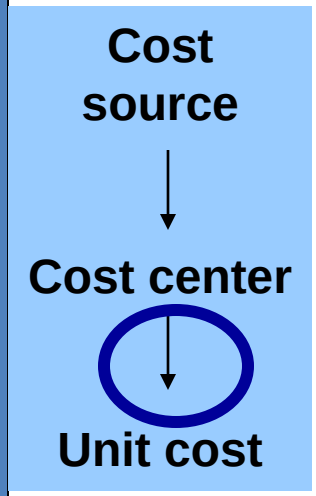
Overheads that occur in the period of 1 year is shown the table above. Conduct overhead apportionment to Department A and Department B according to the appropriate basis of apportionment shown the table below.

Basis of apportionment	Department A	Department B
Machine value	RM 15,000	RM 22,500
Floor area (m^2)	4,000	2,500
Number of workers	20	10
Motor power (hour kW)	100,000	200,000
Direct labour (hour)	25,000	15,000
Machine utilization (hour)	12,500	10,000

Overhead Absorption Rate, OAR
(Kadar Penyerapan Overhed)

Second step

- Transfer of overhead from production cost centre to unit (cost/service)
- Procedure for overhead absorption:
  1. Determine the basis for absorption (labour hour, machine hour and others)
  2. Calculate the Overhead Absorption Rate (OAR):



$$\text{Overhead absorption rate (OAR)} = \frac{\text{Total cost centre overhead}}{\text{Total basic unit specified}}$$

Over and under absorption of overhead

- OAR is calculated based information on the budget.
- Over absorption
  - Overhead absorbed in cost > Actual overhea
- Under absorption
  - Overhead absorbed in cost < Actual overhead
- Adjustment should be made.

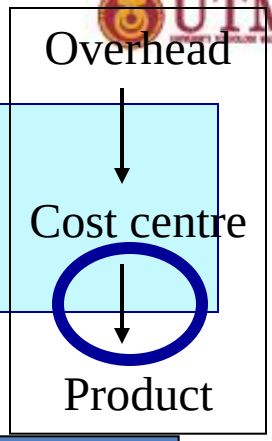
Example : Calculation for Overhead Absorption Rate

	Cost centre X	Cost centre Y
Overhead	**RM 20,000**	**RM 36,000**
Labour hour	**5,000 hour**	**-**
Machine hour	**-**	**6,000 hour**

OAR cost centre X = $\frac{\text{RM 20,000}}{\text{5,000 hour}}$ = RM 4 per labour hour

OAR cost centre Y = $\frac{\text{RM 36,000}}{\text{6,000 hour}}$ = RM 6 per machine hour

OAR = overhead absorption rate (kadar penyerapan overhead)



Example 2

The following are information on 3 production cost centres:

	Department X	Department Y	Department Z
Overhead	RM 12,400	RM 16,300	RM 11,250
Total production (unit)	2,000	4,000	5,000
Direct labour(hour)	2,500	1,000	500
Machine hour	500	2,000	250

Question: Calculate overhead absorption rate (OAR) for each department based on the following basis of absorption:

Cost centre	Base for overhead absorption
Department X	Labour hour
Department Y	Machine hour
Department Z	Production unit

4.3 Apportionment of service centre overhead

- It is difficult to distribute overhead from service centres that provide services to production department and other service centres but it does not produce any tangible product.
- Distribution may be done through secondary apportionment
- Most commonly used methods are :
  - Direct method
  - Step method
  - Reciprocal method

Direct Method

- Cost is distributed directly from each service to production department.
- Services provided by a service centre to other service centres are ignored.
- Most popular method because it is simple.

Solution : Apportionment with reciprocal method

JP's overhead is to be distributed based on capital value .

JK's overhead is to be distributed based on power cost.

Procedure for solution :

1. Determine the percentage capital value JK and other production departments. Capital value of JP is not considered.

2. Determine the percentage power of JP and other production departments. Power for department JK is not considered.

Percentage of capital value and power.

Department	JP	JK	P1	P2	P3
Overhead (RM)	4,800	14,600	33,000	22,000	14,000
Capital value (RM)	-	100,000	640,000	760,000	550,000
% capital		5%	31%	37%	27%
Power (Kwhr)	9,000	-	10,800	16,200	24,000
% power	15%		18%	27%	40%

The equation for JP's overhead after receiving apportionment from JK is X :

- X = 4800 + 0.15Y……(i)

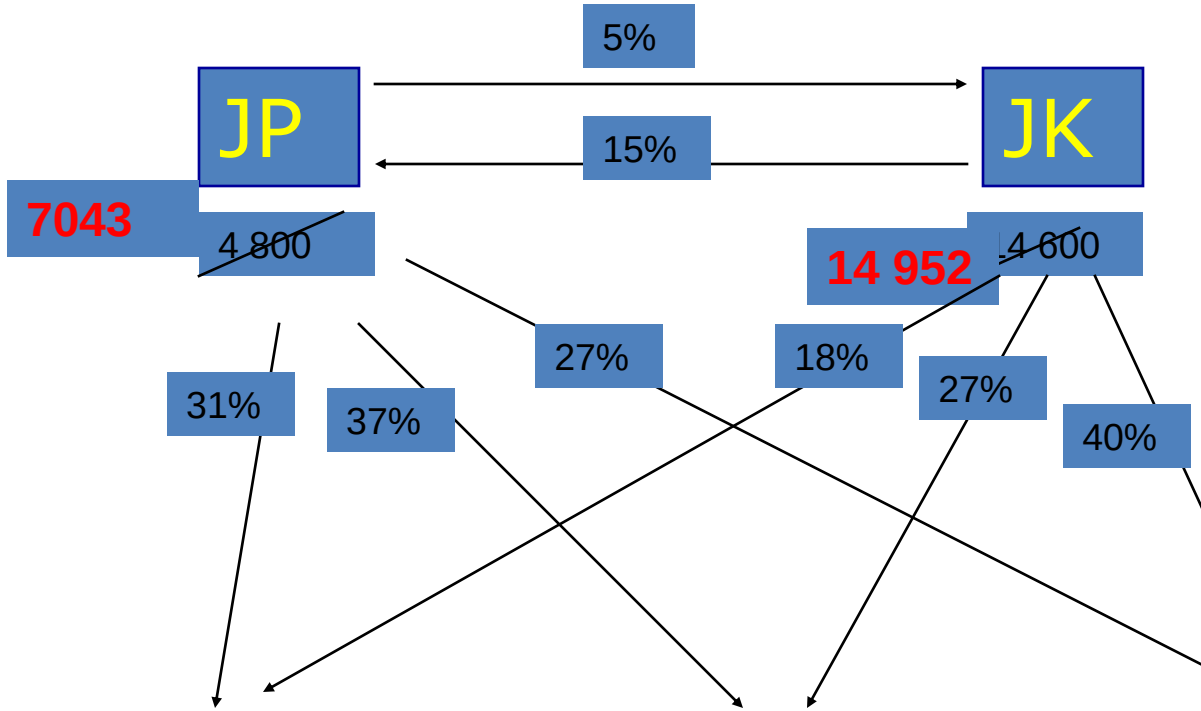
The equation for JK' overhead after receiving overhead from JP is Y :

- Y = 14600 + 0.05X …..(ii)

(X = new overhead for JP and Y = new overhead for JK)

- If both equations are solved simultaneously
  - X = RM7,043.00
  - Y = RM14,952.00

Solution (graphical form)



JP's new overhead

X = 4,800 + (15%x Y)

JK's new overhead

Y = 14,600 + (5% X')

Solving the equations:

X= 7,043

Y= 14,952

	P1	P2	P3
	33 000	22 000	14 000
From JP:	31% x 7043 = 2183	37% x 7043 = 2606	27% x 7043 = 1902
From JK	18% x 14952 = 2691	27% x 14952 = 4037	40% x 14952 = 5981
	Total =37,874	Total =28,643	Total =21,883

Solution (Table Form)

	JP	JK	P1	P2	P3
Initial Overhead	4,800	14,600	33,000	22,000	14,000
JP overhead (Apportioned) (0, 5%, 31%, 37%, 27%)	-7,043	352	2,183	2,606	1,902
JK overhead (Apportioned) (15. 0, 18%, 27%, 40%)	2243	-14,952	2,691	4,037	5,981
Total overhead	**0**	**0**	**37,874**	**28,643**	**21,883**

Example 3

The overhead of 2 production departments and 2 service departments of a Company SA is shown in Table 5.5. Distribute overhead of the 2 servive departments to the production departments according to the following percentages using the reciprocal method:

Table 5.5

Department	P1	P2	S1	S2
Overhead (RM)	16,000	12,000	4,000	2,000
Overhead S1	50%	30%	-	20%
Overhead S2	40%	50%	10%	-

Product Costs

- Factory cost consists of 2 types of cost; direct cost and indirect cost.
- Absorption costing method – all production costs (direct and indirect costs) is absorbed into the product.
- Marginal costing method – only variable costs is considered (that is, all factory direct cost.

4.4 Absorption Costing and Marginal Costing

- Advantages of Marginal Costing
  - Simple.
  - Distribution of fixed cost is not required.
  - When sales does not change but production increase, no effect on profit (but not in absorption costing)
  - Under or over absorption of fixed cost does not occur unlike absorption costing.
  - Fixed costs is deducted as cost in the period (this is appropriate because it has no relation with production volume) .
  - Report status that is close to the actual cash flow

Advantages of Absorption Costing

- Does not neglect fixed costs that constitute the largest percentage of total costs in a modern factory. It should be considered as part of the production costs.
  - If production volume is unchanged but sales volume changes, the amount of fluctuation in profit is minimal as compared to marginal costing.
  - In seasonal business activity that requires stock up, fixed cost should included in stock value. (To avoid showing bad loss during stock up but high profit during sales).
  - The inclusion of fixed costs will avoid the determination of sales price lower than the actual total cost for each unit product.
  - It is suggested that accounting guidelines in the calculation for stock cost and work in progress.

Absorption Costing

- All factory costs is considered to determined production unit cost.
- Example:
  - If 10,000 units of product A is produced and all were sold :
    - Sales(10,000 unit)s RM50,000
    - Factory costs;
      - Variable RM17,500
      - Fixed RM7,500
    - Fixed overhead (Administration & sales) RM12,500

Operation statement (Absorption Costing)

Sales	RM50,000
- Cost of sales (Σ Factory cost)	
(RM17,500 + RM7,500)	RM25,000
= Gross profit	RM25,000
- Overhead (Administration & sales)	RM12,500
= Net profit	RM12,500

Marginal Costing

- Based on factory's variable costs only. Fixed costs are deducted at the end when calculating profit.
- Marginal costs = Total variable costs
  = Costs of (direct material + direct labour + direct expenditure + variable overhead)
- Contribution (Caruman) = Sales – Marginal costs

Marginal Costing

- Two main uses of marginal costing :
  - Short term planning and decision making that involves changes in volume that affect production costs.
  - It is an alternative to absorption costing method in calculating product cost and stock value.

Example: 4

- 10,000 units of product A is produced and sold :
  - Sales (10,000 units) RM50,000
  - Factory costs
    - Variable RM17,500
    - Fixed RM7,500
  - Fixed Overhead (administration & sales) RM12,500

Operation Statement (Marginal Costing)

Sales		RM50,000
- Marginal cost (variable costs only)		RM17,500
= contribution		RM32,500
- Fixed costs :		
Factory	RM7,500	
Administration & sales	RM12,500	RM20,000
= Net profit		RM12,500

Comparison between Marginal Costing and Absorption Costing

Operation Statement (Absorption Costing)

Sales	RM50,000
- Cost of sales (Σ factory costs)	
(RM17,500 & RM7,500)	RM25,000
= Gross profit	RM25,000
- Overhead cost (Administrattion and sales)	RM12,500
= Net profit	RM12,500

Operation Statement (Marginal Costing)

Sales		RM50,000
- Marginal costs (variable costs only)		RM17,500
= contribution		RM32,500
- Fixed costs :		
Factory	RM7,500	
Administration and sales	RM12,500	RM20,000
= Net profit		RM12,500

Example 5

In 2004 KSDN Incorporated produces 200,000 units of product S and all were sold out. Sales and production data are shown in Table 5.7:

Table 5.7

Sale price per unit	RM40
Variable cost per unit	RM20
Total factory fixed cost	RM5,000,000
Administrative fixed cost	RM80,000

In the following year (2005) it produces 350,000 units of product S but only manage to sell 300,000 units with a remainder of 50,000 units unsold. Prepare an operation statement for year 2005 based on :

- Absorption costing method
- Marginal costing method

Limitation of traditional method and latest method.

- Limitations of traditional method (Example: Absorption)
  - It was developed based on percentage of high direct cost and design change, and slow manufacturing method, low overhead cost from supporting department.
  - Absorb overhead based volume of a product, not actual utilization by the product.
  - Will cause overcost and undercost.

- Advantage of latest method (Example: ABC)
  - Provide good solution in estimating product cost.
  - Absorb overhead based on actual utilization or benefit received by a product.
  - Able to minimize overcost and undercost.

4.5 Activity-Based Costing, (ABC)

- Charged overhead cost to unit cost based on benefit received from specific activities.
- More accurate and realistic.
- Show clearly the relationship between overhead cost and the activity that causes the cost to occur.
- The difference between traditional costing is in the way activity costs are gathered and distributed to the unit cost.

Steps to ABC method:

- Identify main activities in the organisation.
- Identify the driving factor (cost driver) – factors that determine the cause of an activity.
- Gather all the cost for each cost pool – just like gathering source cost to cost centers.
- Charge the cost in the cost pool to products based on the activity used and the cost driver selected for each activity.

Similarities and Difference between ABC Costing and Traditional Costing

- Similarities :
  - Direct costs are charged directly to product.
- Differences :
  - Traditional method distribute overhead using labour hour or machine hour but ABC uses cost drivers as the basis of absorption.
  - In cases where overhead cost is high, distribution using ABC is more accurate.

Example 6 : A company produces 4 types of product K, L, M and N. Production data are as follows:

Product	Unit output	Number of runs	Direct labour hour (per unit)	Machine hour (per unit)	Material cost (per unit)	Number of components (per unit)
K	25	3	2	2	RM30	8
L	25	4	4	4	RM75	5
M	250	7	2	2	RM30	8
N	250	10	4	4	RM75	6
Jumlah		**24**				**3825**

Cost rate of direct labour = RM7 per hour

Overhead for each cost pool :

Short term variable cost	=	RM8250
Long term variable cost :		
Scheduling cost	=	RM7680
Set-up cost	=	RM3600
Material handling cost	=	RM7650
		RM27180

Number of components = (25 x 8) + (25 x 5) + (250 x 8) + (250 x 6)

Calculation for product cost using absorption costing method

Calculate rate of overhead absorption.

Product	Total machine hour (hour)
K	25 x 2 = 50
L	25 x 4 = 100
M	250 x 2 = 500
N	250 x 4 = 1000
Total	1650

Overhead absorption rate based on machine hour (OAR) = RM27,180/1650

= RM16.47 per machine hour

Establishing product cost : Cost absorption method

Direct cost (RM)

Direct cost	K	L	M	N	Total
Direct material	750	1875	7500	18750	
Direct labour	350	700	3500	7000	
Prime Cost	1100	2575	11000	25750	**40425**

25 units x RM30 per unit

25 units x 2 direct labour hours x RM7 per hour

Overhead cost (RM)

	K	L	M	N	Total
OAR = (16.47hour)	824	1647	8235	16470	**27177**
Total cost	1924	4222	19235	42220	**67602**
Unit output	25	25	250	250	
Cost per unit	77	169	77	169	

1100 + 824

1924 / 25

25 units x 2 machine hour x 16.47

40425 + 27177

Determining Product Cost Using ABC Costing Method

- Costing is based on activity using the following cost drivers :

Aktivity	Cost driver
Short term	Machine hour
Scheduling	Number of runs
Set-up	Number of runs
Material handling	Number of components

Determining product cost : ABC Costing Methods

Direct cost (RM)

Direct cost	K	L	M	N	Total
Direct material	750	1875	7500	18750	
Direct labour	350	700	3500	7000	
Prime cost	1100	2575	11000	25750	**40425**

25 units x RM30 per unit

25 units x 2 direct labour hour x RM7 per hour

Cost driver rate

Activity cost		Cost driver rate
Short term variable cost	RM8250 /1650 machine hour	RM5 per machine hour
Scheduling cost	RM7680 / 24 runs	RM320 per run
Set-up cost	RM3600 / 24 runs	RM150 per run
Material handling cost	RM7650 / 3825 components	RM2 per component

Determining product cost : ABC Costing Methods

25 units x 2 machine hour x RM5

3 runs x RM320

Overhead	K	L	M	N	Total
Short term variable cost (RM5 per machine hour)	250	500	2500	5000	8250
Scheduling (RM320 per run)	960	1280	2240	3200	7680
Set-up (RM150 per run)	450	600	1050	1500	3600
Material handling (RM2 per component)	400	250	4000	3000	7650
Total cost	3160	5205	20790	38450	67605
Production unit	25	25	250	250	
Overhead cost per unit	**126.4**	**208.2**	**83.16**	**153.8**	

3 runs x RM150

25 units x 8 components x RM2

Result Comparison

	K	L	M	N
Output Unit	25	25	250	250
Cost per unit (Traditional)	77	169	77	169
Cost per unit (ABC)	126.4	208.2	83.16	153.8
Difference	49.4	39.2	6.16	-15.2
% difference (if use ABC)	+64%	+23%	+8%	-9%

% difference = (ABC cost –Traditional cost) x 100%
Traditional cost

Comment :

ABC charged high overhead to low volume product and charged less overhead to high volume product.

ABC charged cost based on activity used not on production volume.

4.6 Chapter Summary

- ABC Per unit cost is more accurate.
- ABC allows more overhead can be link directly to each product. Charged cost to activity that causes the cost to occur. It can identify the real characteristics of a cost and help reduce non value added activity.
- ABC is suitable for making long term decisions because long term variable cost can be analysed more accurately. It can identify processing cost, customer cost and other management cost.

Limitations to ABC method

- Need more multi cost pool and cost drivers.
- More complicated and may increase management cost.
- May not be suitable for small companies or companies that determine its product cost based on market price.
- Problem of joint cost, selection of cost drivers and non-linear cost drivers.