



## **PRODUCT COSTING**

\* *VARIABLE COSTING*

\* *ABSOPTION COSTING*

\* *TOWARDS THE EMERGENCE OF ACTIVITY-BASED COSTING*

## **VARIABLE COSTING**

is a method of inventory costing in which all direct manufacturing costs and variable manufacturing overhead costs are included as inventoriable costs; fixed manufacturing overhead costs are excluded from the inventoriable costs and are costs of the period in which they are incurred.

## **ABSORPTION COSTING**

is a method of inventory costing in which all direct manufacturing costs and all manufacturing overhead costs-both variable and fixed-are considered as inventoriable costs. That is, inventory “absorbs” all these costs.

**Fixed Manufacturing  
Overhead Costs  
to Account for in 1997**

**Inventoriable Costs**

**Expenses in 1997**

**VARIABLE  
COSTING**

\$ 2,200,000

\$ 2,200,000

Expire as a  
period cost  
when incurred

**ABSORPTION  
COSTING**

\$ 2,200,000

Addition to inventory  
in 1997:

1,100,000 x \$2.00 = \$2,200,000

Ending inventory

(December 31, 1997):

100,000 x \$2.00 = \$200,000

Cost of goods sold in 1997

1,000,000 x \$2.00

\$2,000,000

**Contribution Margin** = Revenues - All costs that vary with respect to an output-related driver (*activity volume*)

**Gross Margin** = Revenues - Cost of goods sold

The phrase “all costs that vary” refers to variable costs in each of the business function areas of the value chain (research and development; design of products, services, for processes; production; marketing; distribution; and customer service).

- *Cost of goods sold in the merchandising sector is a variable cost made up of goods purchased for resale.*
- **Cost of goods sold in the manufacturing sector consists of all manufacturing costs (including fixed manufacturing costs).**
- *Service-sector companies can compute a contribution margin figure but not a gross margin figure. Service - sector companies do not have a cost of goods sold line item on their income statement.*

	<b>Total</b>
Revenues, \$200 x 25 units	\$ 5,000
Variable costs, \$120 x 25 units	<u>\$ 3,000</u>
Contribution margin, \$80 x 25 units	\$ 2,000
Fixed costs	<u>\$ 2,000</u>
Operating income	<u><u>\$ 0</u></u>

A **Contribution income statement** groups individual line items to highlight the contribution margin, which is the difference between revenues and all costs that vary with respect to an output -related driver



## Example

Selling Price	\$17,00
Variable costs per unit:	
Direct materials	\$3,50
Direct manufacturing labor	\$1,60
Variable manufacturing overhead costs	<u>\$0,90</u>
Total variable manufacturing costs	\$6,00
Variable marketing and administrative cost	<u>\$2,40</u>
Total variable costs per unit	\$8,40
Fixed costs	
Fixed manufacturing overhead costs	\$2.200.000
Fixed marketing and administrative costs	<u>\$5.500.000</u>
Total fixed costs	<u><u>\$7.700.000</u></u>
No beginning inventory of finished goods	
Sale volume	1.000.000 units
Production volume	1.100.000 units

*Comparison of Variable Costing and Absorption Costing  
Income Statements for the Year Ended December 31, 1997  
for Radius Company (in thousands)*

**Panel A: Variable Costing**

Sales: \$ 17.00 x 1.000.000 units		<u>\$17.000</u>
Variable costs		
Beginning inventory	\$0	
Variable cost of goods manufactured: \$ 6.00 x 1.100.000	+ \$6.600	
Cost of goods available for sale	\$6.600	
Ending inventory: \$ 6.00 x 100.000	- \$600	
Variable manufacturing cost of goods sold	\$6.000	
Variable marketing and administrative costs	+ \$2.400	
Total variable costs		<u>- \$8.400</u>
Contribution margin		\$8.600
Fixed costs		
Fixed manufacturing overhead costs	- \$2.200	
Fixed marketing and administrative costs	- \$5.500	
Total fixed costs		<u>\$7.700</u>
Operating income		<u><u>\$900</u></u>

### Panel B: Absorption Costing

Sales: \$ 17.00 x 1.000.000 units		<u>\$17.000</u>
Cost of goods sold		
Beginning inventory	\$0	
Variable manufacturing costs: \$ 6.00 x 1.100.000	+ \$6.600	
Fixed manufacturing costs allocated: \$ 2.00 x 1.100.000	+ \$2.200	
Cost of goods available for sale	<u>\$8.800</u>	
Ending inventory: \$ 8.00 x 100.000	\$800	
Adjustment for variances	<u>\$0</u>	
Total cost of goods sold		<u>\$8.000</u>
Gross margin		\$9.000
Marketing and administrative		
Variable marketing and administrative costs	\$2.400	
Fixed marketing and administrative costs	<u>\$5.500</u>	
Total marketing and administrative costs		<u>\$7.900</u>
Operating income		<u><u>\$1.100</u></u>



**The income statement under variable costing deducts the \$2,200,000 lump sum as a period cost in 1997. In contrast, the income statement under absorption costing regards each finished unit as bearing \$2 of fixed manufacturing overhead.**

**Under absorption costing the \$2,200,000 is initially capitalized as an inventory cost in 1997. Subsequently, \$2,000,000 becomes an expense in 1997, and \$200,000 remains an asset- part of ending inventory, 100,000 units x \$2-at December 31, 1997. The variable manufacturing costs are accounted for in the same way in both income statements.**

**Never overlook the heart of the matter. The differences between variable costing and absorption costing center on how to account for fixed manufacturing overhead.**

*If inventory levels change, income will differ because of the different accounting for fixed manufacturing overhead. Compare sales of 900,000 1,000,000, and 1,100,000 units by Radius Company in 1997. Fixed manufacturing overhead would be included in the 1997 expense as follows:*

	Fixed Manufacturing Overhead Costs Treated as an Expense in 1997
Variable costing, whether sales are 900,000, 1,000,000, or 1,100,000 units	\$2,200,000
Absorption costing, where:	
* sales are 900,000 units, \$400,000 (200,000 x \$2) held back in inventory	\$1,800,000
* sales are 1,000,000 units, \$200,000 (100,000 x \$2) held back in inventory	\$2,000,000
* sales are 1,100,000 units, \$0 held back in inventory	\$2,200,000

## Manufacturing Sector

The two areas of difference between contribution margin and gross margin for companies in the manufacturing sector are fixed manufacturing costs and variable non-manufacturing costs. The following example illustrates this difference (numbers assumed):

Revenues		\$1.000
Variable manufacturing costs	\$250	
Variable non-manufacturing cost	\$270	\$520
Contribution margin		<u><b>\$480</b></u>
Fixed manufacturing costs	\$160	
Fixed non-manufacturing costs	\$138	\$298
Operating income		<u><u><b>\$182</b></u></u>

Revenues	\$1.000
Cost of goods sold (\$250+\$160)	<u>\$410</u>
Gross margin	<b>\$590</b>
Non-manufacturing costs (\$270+\$138)	<u>\$408</u>
Operating income	<u><u><b>\$182</b></u></u>

*Fixed manufacturing costs are not deducted from sales when computing contribution margin, but are deducted when computing gross margin.*

*Cost of goods sold in a manufacturing company includes all manufacturing costs.*

*Variable non-manufacturing costs are deducted from sales when computing contribution margins but are not deducted when computing gross margins.*

Both the *contribution margin* and the *gross margin* can be expressed as total, as an amount per unit, or as percentages. The **contribution-margin** percentage is the total contribution margin divided by revenues. The **variable-cost percentage** is the total variable cost (with respect to an output-related factor) divided by revenues. The contribution - margin percentage in our manufacturing sector example is 48% ( $\$480/\$1,000$ ), while the variable - cost percentage is 52% ( $\$520/\$1,000$ ). The gross margin percentage is 59% ( $\$590/\$1,000$ ).

## OVERVIEW OF ABSORPTION PRODUCT COSTING

CAI assembles the deluxe refrigerator, along with eight other products, at its Windsor, Ontario, plant. It uses its own sales force to sell refrigerators to retail department stores.

### ***STEP 1: IDENTIFY THE PRODUCT THAT IS THE CHOSEN COST OBJECT***

The cost object is a deluxe refrigerator model.

## ***STEP 2: IDENTIFY THE DIRECT COST CATEGORIES FOR THE PRODUCT.***

CAI identifies three categories of direct costs. One direct cost is for customer warranty. CAI pays a third-party electrical goods repair company \$75 per refrigerator to handle customer requests for service during the 24-month warranty period. At the Windsor manufacturing plant, there are two direct costs - direct materials and direct manufacturing labour. Amounts traced to each deluxe refrigerator model are:

Customer warranty	\$ 75
Direct materials	140
Direct manufacturing labour	<u>35</u>
Total direct costs	<u><u>\$250</u></u>



### ***STEP 3: IDENTIFY THE INDIRECT COST POOLS ASSOCIATED WITH THE PRODUCT***

CAI identifies six indirect cost pools associated with the manufacturing and sale of the deluxe refrigerator. These six pools are listed below:

- |  |  |                        |
|--|--|------------------------|
| <b>1. PROCUREMENT</b>                      | <b>3. PRODUCTION: machine-paced assembly</b> | <b>5. DISTRIBUTION</b> |
| <b>2. PRODUCTION: labor-paced assembly</b> | <b>4. PRODUCTION: quality testing</b>        | <b>6. MARKETING</b>    |

### ***STEP 4: SELECT THE COST ALLOCATION BASE TO USE IN ASSIGNING EACH INDIRECT COST POOL TO THE PRODUCT.***

The chosen cost-allocation bases are also listed below in step 5.

***STEP 5: DEVELOP THE RATE PER UNIT OF THE COST ALLOCATION BASE  
USED TO ALLOCATE INDIRECT COSTS TO THE PRODUCT.***

The allocation base and rate for each indirect cost pool in the January  
to June 1997 period is:

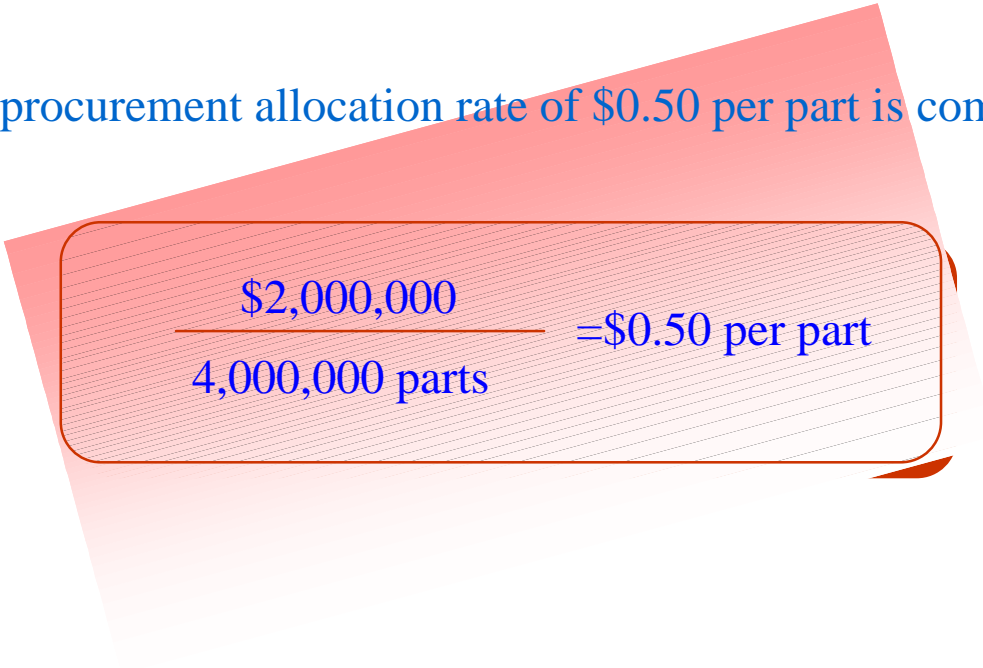
Indirect Cost Pool	Allocation Base	Allocation Rate
1. Procurement	Numbers of parts	\$ 0.50
2. Production: Labor-paced assembly	Direct manufacturing labor- hours	\$20 per hour
3. Production: machine- paced assembly	Machine-hours	\$16 per hour
4. Production: quality testing	Testing hours	\$30 per hour
5. Distribution	Cubic feet	\$2 per cubic foot
6. Marketing	Units sold	\$70 per unit

***These rates are revised every six months.***

***The allocation rate for each indirect cost pool is calculated as:***

$$\text{Budget indirect cost rate} = \frac{\text{Budgeted total costs in indirect cost pool}}{\text{Budgeted total quantity of cost-allocation base}}$$

For example, the procurement allocation rate of \$0.50 per part is computed as follows:


$$\frac{\$2,000,000}{4,000,000 \text{ parts}} = \$0.50 \text{ per part}$$

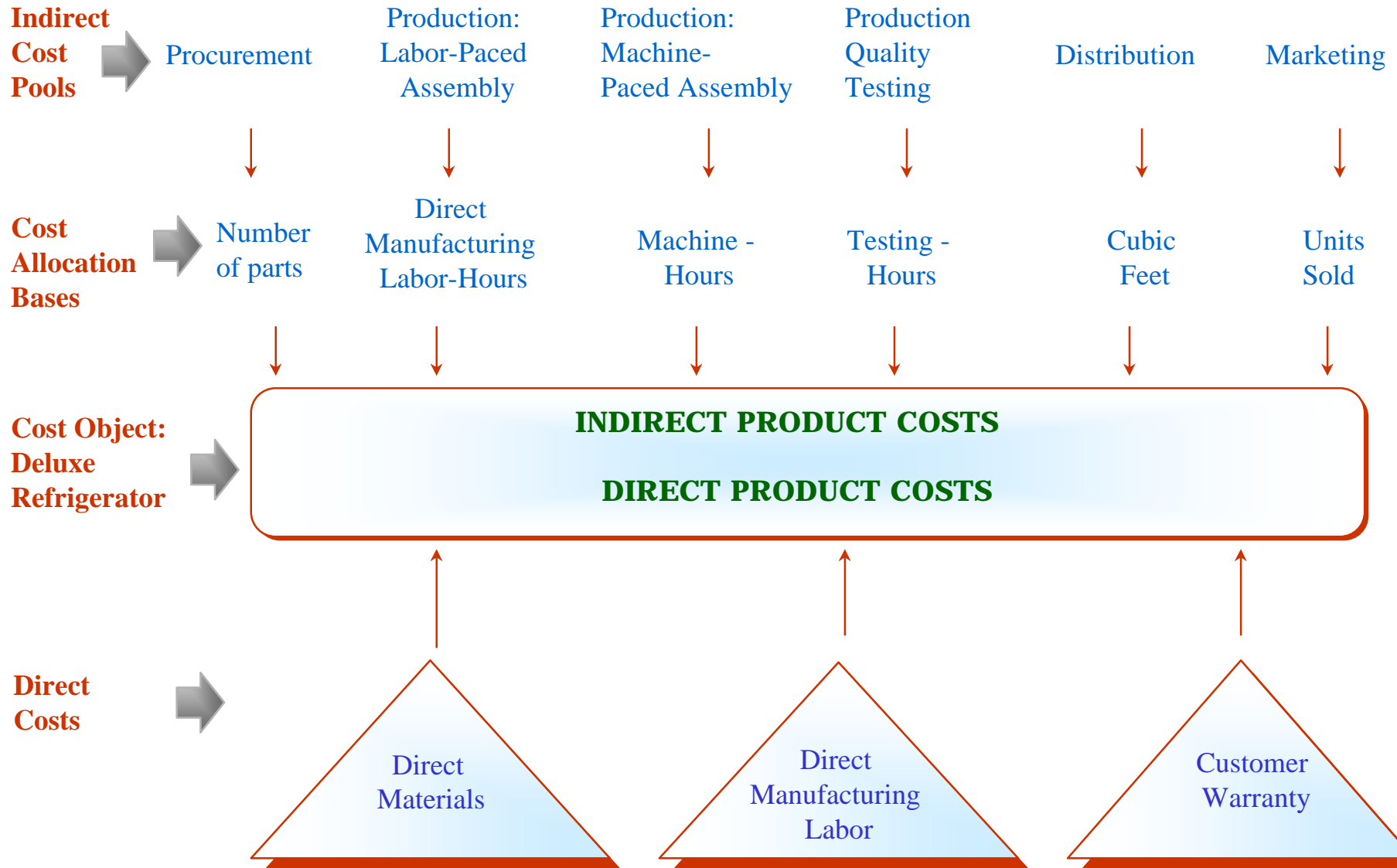
## **NUMERATOR**

The budgeted total costs for the procurement cost pool in the January to June 1997 period are \$2,000,000. This amount includes costs for labour in the procurement department, for their equipment (for example, computers), and for the handling and inspection of incoming materials.

## **DENOMINATOR**

The budgeted total quantity of the allocation base is 4,000,000 parts. This figure is the budgeted number of parts for all products assembled at the Windsor plant in the January to June 1997 period. It includes a budget of 252,000 parts for the deluxe refrigerator model (84 parts per refrigerator times the 3,000 budgeted production units of refrigerators). The remaining 3,748,000 parts included in the denominator are for other products.

## Overview of product Costing at Consumer Appliances, Inc.



## Costing of Deluxe Refrigerator Model of Consumer Appliances, Inc.

<b>FULL PRODUCT COST = \$530</b>	<b>Direct Product Costs</b>			
	Customer warranty		\$75	
	Direct materials		\$140	
	Direct manufacturing labor		\$35	
			<u>\$250</u>	
	<b>Indirect Product Costs</b>			
	Procurement 84 parts x \$0.50		\$42	
	Production: labor-paced assembly 0.50 hours x \$20		\$10	
	Production: machine-paced assembly 3.0 hours x \$16		\$48	
	Production: quality testing 1.0 hours x \$30		\$30	
	Distribution 40 cubic feet x \$2		\$80	
	Marketing 1.0 unit sold x \$ 70		\$70	
			<u>\$280</u>	
	<b>Full Product Costs</b>		<u><b>\$530</b></u>	

**INVENTORIABLE  
PRODUCT  
COST = \$305**





## **SOME ARGUMENTS IN SUPPORT OF VARIABLE COSTING**

**\* Variable costing provides more useful information for decision-making. The estimation of costs for different levels of activities requires that costs be split into their fixed and variable elements.**

**\* Variable costing removes from profit the effect of stock changes**

***\* Variable costing avoids fixed overheads being capitalized in unsaleable stocks with in absorption costing system, only a portion of fixed overheads incurred during the period will be charged as an expense because the remainder of the fixed overheads will be included in the valuation of the surplus stocks. This is particularly true in a period when stocks increase as sales demand decreases.***

## **ACTIVITY BASED COSTING:**

**Activity-based costing emphasizes the need to obtain a better understanding of behaviour of overhead costs, and thus ascertains what causes overhead costs and how they relate to products. ABC recognizes that in the long run, most manufacturing costs are not fixed, and it seeks to understand the forces that cause overhead costs to change over time.**



*ABC system assume that activities cause costs and that products create the demands for activities.*

*A link is made between activities and products by assigning costs of activities to products based on an individual product's consumption or demand for each activity.*

***ABC systems simply recognize that businesses must understand the factor that drive each major activity, the cost of activities and how activities relate to products.***

**THE DESIGN OF ABC SYSTEMS INVOLVES THE FOLLOWING STAGES:**

- 1. IDENTIFYING THE MAJOR ACTIVITIES THAT TAKE PLACE IN AN ORGANIZATION;**
- 2. CREATING A COST POOL/COST CENTRE FOR EACH ACTIVITY;**
- 3. DETERMINING THE COST DRIVER FOR EACH MAJOR ACTIVITY;**
- 4. ASSIGNING THE COST OF ACTIVITIES TO PRODUCTS ACCORDING TO THE PRODUCTS' DEMAND FOR ACTIVITIES.**

## **FIRST STAGE**

The first stage is to identify the major activities in the organization.

Example of activities include machine-related activities (e.g. machining cost centres), direct labour-related activities such as ordering, receiving, materials handling, parts administration, production scheduling, packing and despatching.

## **SECOND STAGE**

The second stage requires that a cost centre (also called a cost pool) be created for each activity. For example, the total cost of all set-ups might constitute one cost centre for all set-up related costs.

## THIRD STAGE

The third stage is to identify the factors that influence the cost of a particular activity. The term “cost driver” is used to describe the events or forces that are significant determinants of the cost of the activities.



### EXAMPLE:

If production scheduling cost is generated by the number of production runs that each product generates, then the number of set-ups would represent the cost driver for production scheduling. ABC recognizes that cost behaviour is dictated by cost drivers, and therefore the tracing of overhead costs to products requires that cost behaviour must be understood so that appropriate cost drivers can be identified.

***Some of the cost drivers used by ABC systems include:***

- \* the number of receiving orders for the receiving department**
- \* the number of production runs undertaken for scheduling and set-up costs**
- \* the number of purchase orders for the cost of operating the purchasing department and**
- \* the number of despatch orders for the despatch department.**

*For those costs that are purely variable with output in the short term, ABC systems use volume-related cost drivers such as direct labour hours or machine hours. For example, power costs can be traced to products using machine hours as the cost driver, since machine hours drive the consumption of power. Thus if production increases by 10%, the consumption cost and the number of machine hours will increase by 10%.*

The **final stage** is to trace the cost of the activities to products according to the product's demand (using cost drivers as a measure of demand) for these activities during the production process.

A product's demand for the activities is measured by the number of transaction it generates for the cost driver.



**EXAMPLE:**

Assume, for example, that the total cost traced to the cost centre for set-up related costs was £. 100.000 per set-up. To determine the set-up costs for a particular product, the number of set-ups for the product would be multiplied by £. 1.000. Thus the cost per unit for one batch of 20 units will be £. 50 (£1.000/20 units). ABC would trace the costs of other activities to products using a similar approach.

## A comparison of ABC with traditional costing systems

*Company A produces two products H and L. Both are produced on the same equipment and use similar processes. The products differ by volume. Product H is a high-volume product. Details of product inputs, output and cost of activities are as follows:*

	Machine hours per unit	Direct labour hours per unit	Annual output (units)	Total machine hours	Total direct labour hours	N° of purchase orders	N° of set- ups
<b>Product L</b>	2	4	1.000	2.000	4.000	80	40
<b>Product H</b>	2	4	10.000	20.000	40.000	160	60
				<u>22.000</u>	<u>44.000</u>	<u>240</u>	<u>100</u>

*The cost of the activities is as follows:*

	(£)
Volume-related	110.000
Purchasing-related	120.000
Set-up-related	<u>210.000</u>
	<u><u>440.000</u></u>

## **TRADITIONAL VOLUME-BASED COSTING SYSTEM**

(1) Cost -centre allocated costs	440.000	
(2) Overhead allocation base	22.000	Total machine hours
(3= $1/2$ ) Overhead rate per machine hour	20	
(4) Overhead allocation base	44.000	Total direct labour hours
(5= $1/4$ ) Overhead rate per direct labour hour	10	
<b>Machine hours per unit:</b>		
(6) product L	2	
(7) product H	2	
<b>Cost per unit:</b>		
(8= $3*6$ ) product L	40	
(9= $3*7$ ) product H	40	
<b>Annual output (units):</b>		
(10) product L	1.000	
(11) product H	10.000	
<b>Total cost allocated to products:</b>		
(12= $8*10$ ) product L	40.000	
(13= $9*11$ ) product H	400.000	

## **ACTIVITY-BASED COSTING SYSTEM**

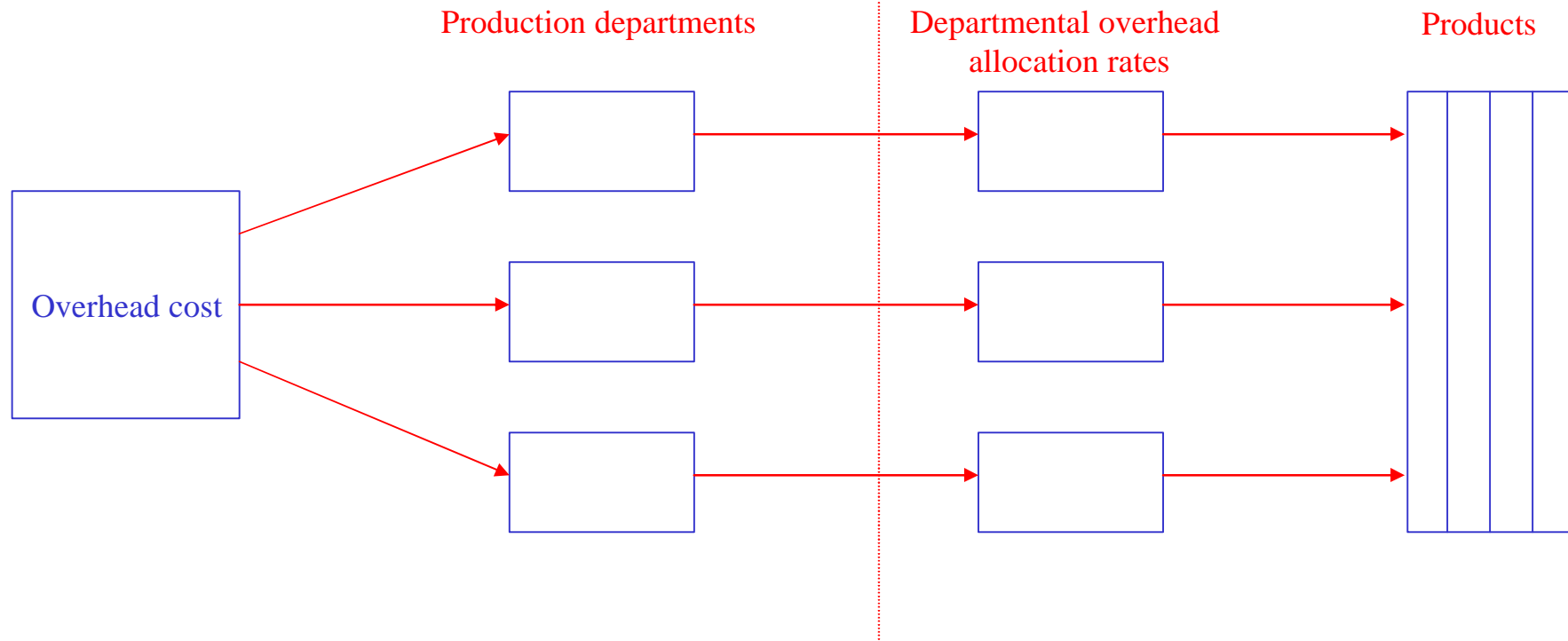
	Volume-related	Purchasing-related	Set-up related
Costs traced to activities	110.000	120.000	210.000
Consumption of activities (cost drivers)	22.000	240	100
Cost per unit of consumption	5	500	2.100
Costs traced to products:			
product L	10.000	40.000	84.000
product H	100.000	80.000	126.000
<b>Total cost allocated to products:</b>			
product L	134.000		
product H	306.000		
<b>Cost per units:</b>			
product L	134		
product H	30,60		



## (a) Traditional product costing system

Stage 1: Overheads assigned to production departments

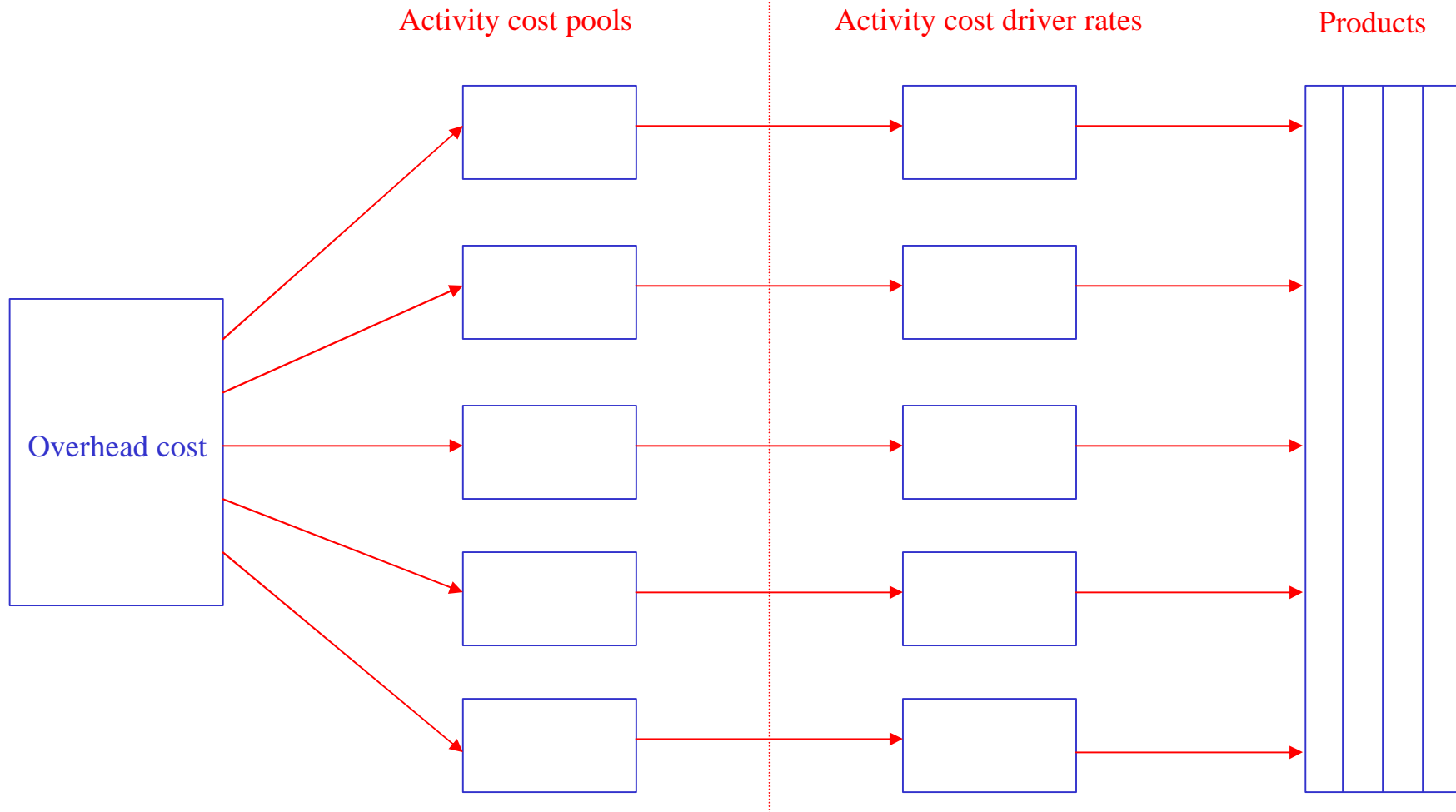
Stage 2: Overheads allocated to products



## (b) Activity-based product costing system

Stage 1: Overheads assigned to cost centres/cost pools

Stage 2: Overheads assigned to products using cost driver rates



Comparison of traditional (a) and activity-based (b) costing system  
Adapted from Innes and Mitchell (1990).