



# Activity Based Costing

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# Cost smoothing

- **Cost smoothing** is a term used to describe a costing approach that uses broad averages to **uniformly** assign the cost of resources to cost objects (such as products, services or customers) when the individual products, services or customers **in fact use those resources in a non-uniform way**.
- Cost smoothing can lead to **undercosting** or **overcosting** of products or services:
  - **Product undercosting.** A product consumes a relatively high level of resources but is reported to have a relatively low total cost. Companies that undercost products may actually make sales that result in losses under the erroneous impression that these sales are profitable.
  - **Product overcosting.** A product consumes a relatively low level of resources but is reported to have a relatively high total cost. Companies that overcost products run the risk of losing market share to existing or new competitors.



# Product – Cost Cross – Subsidization

- **Product – cost cross – subsidization** means that at least one miscosted product is resulting in the miscosting of other products in the organization.
- A classic example arises when a cost is uniformly spread across multiple users without recognition of their different resource demands.
- Consider the costing of a restaurant bill for four colleagues who meet once a month to discuss business developments. Each diner orders separate entrées, desserts and drinks. The restaurant bill for the most recent meeting is as follows:

	Entrée	Dessert	Drinks	Total	
Emmanuelle	€ 55	€ 0	€ 20	€ 75	Under-costed
Jean-Paul	€ 100	€ 40	€ 70	€ 210	Over-costed
Nathalie	€ 75	€ 20	€ 40	€ 135	
Christophe	€ <u>70</u>	€ <u>20</u>	€ <u>30</u>	€ <u>120</u>	Under-costed
Total	€ <u>300</u>	€ <u>80</u>	€ <u>160</u>	€ <u>540</u>	
Average	€ 75	€ 20	€ 40	€ <b>135</b>	Average cost per dinner



# Traditional Costing Systems and Cost Smoothing

- Traditional cost systems were created when manufacturing processes were labor intensive.
- A single company-wide overhead allocation rate based on direct labor hours may be used to allocate overhead to products in these labor-intensive processes.
- Example:

	Job 1	Job 2
Labor Hours	2	6

- In this example, overhead will be allocated to jobs using direct labor hours. If total overhead is \$120, how much will be allocated to each job?
- Calculations:
  - Overhead Rate =  $\$120 \div 8$  direct labor hours
  - Overhead Rate = \$15 per direct labor hour
  - Job 1 = 2 hours  $\times$  \$15 per hour = \$30
  - Job 2 = 6 hours  $\times$  \$15 per hour = \$90

	Job 1	Job 2
Labor Hours	2	6
Overhead Allocation	\$ 30	\$ 90



# Traditional Costing Systems and Cost Smoothing

- Assume that the company introduces automated machinery. Total overhead rises from \$120 to \$420, while the labor time needed for Job 2 falls from 6 hours to 1 hour. Now allocate the \$420 overhead o the two jobs.
- Calculations:
  - Overhead Rate =  $\$420 \div 3$  direct labor hours
  - Overhead Rate = \$140 per direct labor hour
  - Job 1 = 2 hours  $\times$  \$140 per hour = \$280
  - Job 2 = 1 hour  $\times$  \$140 per hour = \$140

	Job 1	Job 2
Labor Hours	2	1
Overhead Allocation	\$ 280	\$ 140

- Is this a reasonable costing method?
- Automation benefited only Job 2, but most of the additional overhead cost was allocated to Job 1.
- Clearly, we need to look for another cost driver.



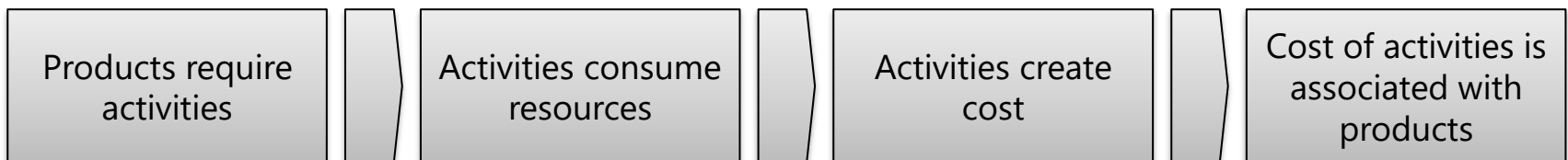
# Refining a Costing System

- A refined costing system reduces the use of broad averages for assigning the cost of resources to cost object and provides better measurement of the costs of indirect resources used by different cost objects.
- Reasons for refining a cost system:
  - Increase in product diversity
  - Increase in indirect costs
  - Advance in information technology
  - Competition in product markets
- Ways of refining a cost system:
  - Direct cost tracing
  - Indirect cost pools
  - Cost allocation bases



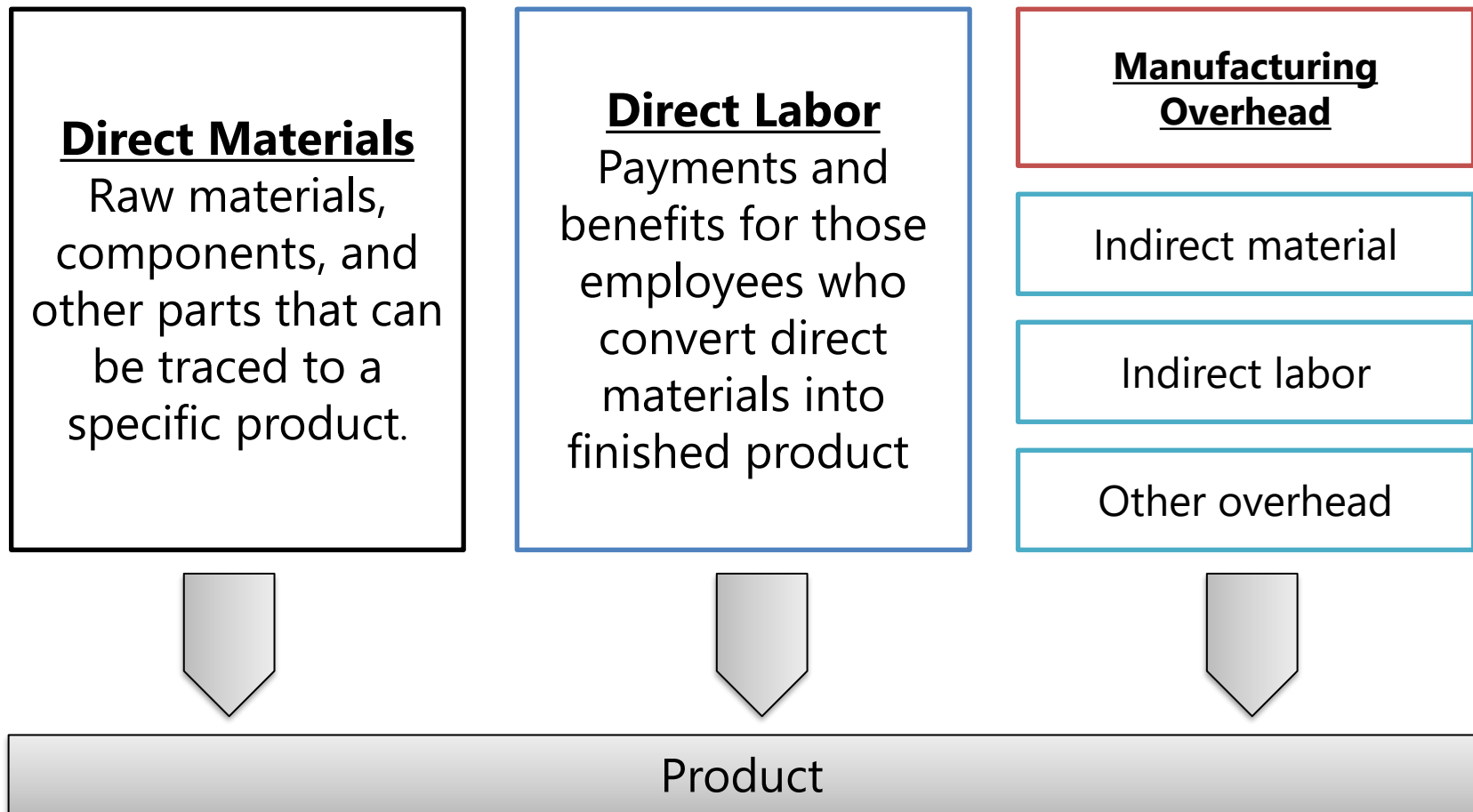
# Activity Based Costing

- One often-used approach for refining a costing system is activity-based costing.
- **Activity-based costing (ABC) systems** refine costing systems by focusing on individual **activities** as the fundamental **cost objects**.
- An activity is an event, task, or unit of work with a specified purpose, for example designing products, setting up machines, operating machines and distributing products.
- ABC systems calculate the costs of individual activities and assign costs to cost objects such as products and services on the basis of the activities undertaken to produce each product or service.





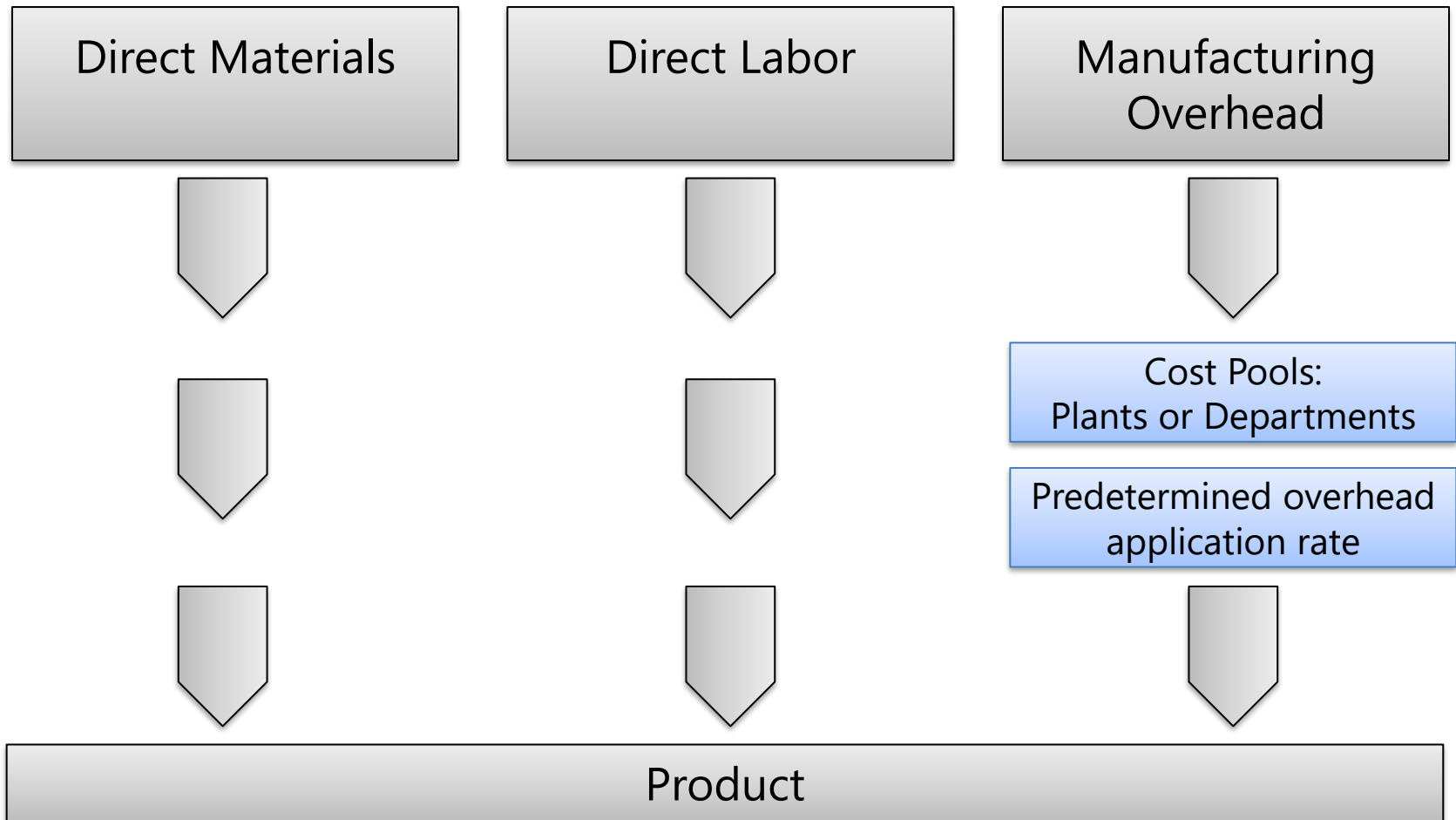
# Recall: 3 Major Categories Of Manufacturing Costs





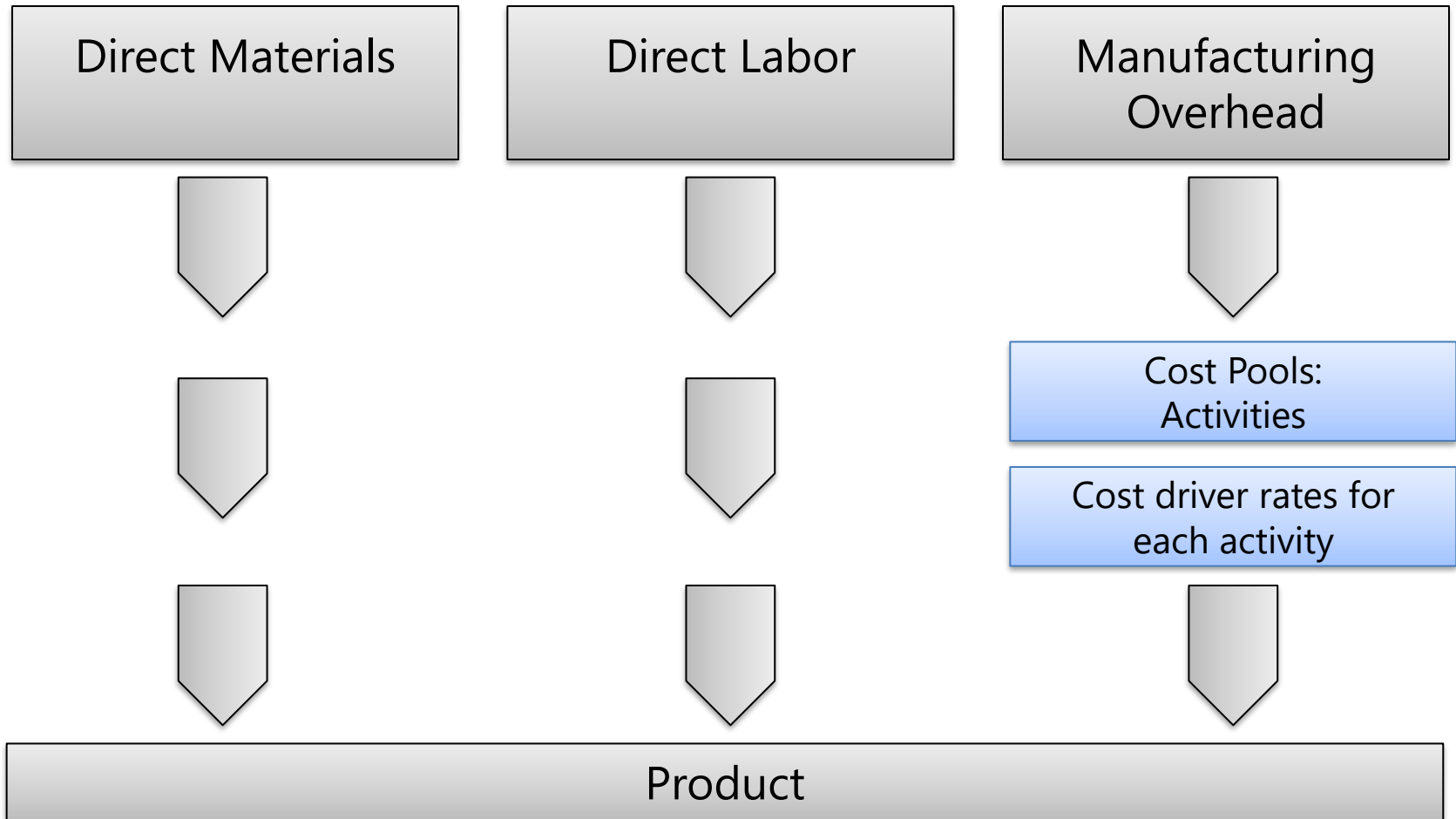


# ABC Compared with Traditional Costing: Traditional Approach





# ABC Compared with Traditional Costing: ABC Approach





# Four Steps in the ABC Process

1. Identify and classify (see previous slide) the activities related to the company's products or services.
  1. Use documents, talk to people (interviews, questionnaires), on-site inspection
  2. Set up activity dictionary
2. Estimate the cost of each activity identified in (1).
3. Calculate a cost-driver rate for each activity.
  1. Divide the cost of (2) by the driver volume (practical capacity). Driver volume usually corresponds to the number of times of driver incurrence
4. Assign activity costs to products using the cost-driver rate as calculated in step 3.



# Cost Hierarchy and Activities

- Unit-level activities
  - Includes direct material, direct labor, utilities to run equipment, other overhead directly related to the production process
- Batch-level activities
  - Includes setup costs, material-handling costs related to delivering raw material to the production line, etc
- Product-level activities
  - Includes design costs for product lines and marketing costs for each product line
- Customer-level activities
  - Includes costs for delivering products to customers, contracting, order placing etc.
- Facility level activities
  - Includes production manager's salary, plant depreciation and insurance on the facility and equipment



# ABC Compared with Traditional Costing: Example - Single Indirect-cost Pool System

- Plastim uses a job-costing system with a single indirect-cost rate.
- Assume that Plastim produces and sells the S3 and CL5 lenses.
- **Step 1: Identify the chosen cost objects.** The cost objects are the 60.000 simple S3 lenses, and the 15.000 complex CL5 lenses that Plastim makes. Plastim's goal is to calculate the *total* costs of manufacturing and distributing these lenses. Plastim then determines unit costs of each lens by dividing total costs of each lens by 60.000 for S3 and 15.000 for CL5.
- **Step 2: Identify the direct costs of the products.** Plastic identifies the direct costs of the lenses – direct materials and direct manufacturing labour – as follows:

	60 000 Simple lenses (S3)		15 000 Complex lenses (CL5)		Total (3) = (1) +(2)
	Total (1)	Per unit	Total (2)	Per unit	
Direct materials	€ 1 125 000	€ 18.75	€ 675 000	€ 45.00	€ 1 800 000
Direct manufacturing labour	€ 600 000	€ 10.00	195 000	€ 13.00	€ 795 000
Total direct costs	€ 1 725 000	€ 28.75	€ 870 000	€ 58.00	€ 2 595 000



# ABC Compared with Traditional Costing: Example - Single Indirect-cost Pool System

- **Step 3: Select the cost-allocation bases to use for allocating indirect costs to the products.** Most of the indirect costs consist of salaries paid to supervisors, engineers, manufacturing support and maintenance staff that support direct manufacturing labour. Hence, Plastim uses direct manufacturing labour-hours as the only allocation base to allocate all indirect costs to S3 and CL5. In the current year, Plastim used 39 750 actual direct manufacturing labour-hours.
- **Step 4: Identify the indirect costs associated with each cost-allocation base.** Plastim groups all indirect costs totaling €2 385 000 into a single overhead cost pool.
- **Step 5: Compute the rate per unit of each cost-allocation base used to allocate indirect costs to the products:**

$$\begin{aligned}\text{Actual indirect-cost rate} &= \frac{\text{Actual total costs in indirect-cost pool}}{\text{Actual total quantity of cost-allocation base}} \\ &= \frac{\text{€2 385 000}}{39\,750 \text{ hours}} = \text{€ 60 per direct manufacturing labour-hour}\end{aligned}$$



# ABC Compared with Traditional Costing: Example - Single Indirect-cost Pool System

- **Step 6: Compute the indirect costs allocated to the products.** Plastim uses 30000 total direct manufacturing labour-hours to make the simple S3 lenses and 9750 direct manufacturing labour-hours to make the complex CL5 lenses.
  - [Indirect costs of € 1800000 (€ 60 per direct manufacturing labour-hour x 30000) allocated to the simple lens and € 585 000 (€ 60 per direct manufacturing labour-hour x 9750) allocated to the complex lens].
- **Step 7: Compute the total cost of the products by adding all direct and indirect costs assigned to them**

	60 000 Simple lenses (S3)		15 000 Complex lenses (CL5)		Total (3) = (1) + (2)
	Total (1)	Per unit	Total (3)	Per unit	
Direct materials	€ 1 125 000	€ 18.75	€ 675 000	€ 45.00	€ 1 800 000
Direct manufacturing labour	600 000	10.00	195 000	13.00	795.000
Total direct costs	1 725 000	28.75	870 000	€ 58.00	2 595 000
Indirect costs allocated	1 800 000	30.00	585 000	39.00	2 385 000
Total costs	€ 3 525 000	€ 58.75	€ 1 455 000	€ 97.00	€ 4 980 000



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- Plastim's team identifies seven major activities:
  - Design products and processes.
  - Set up moulding machine to ensure the mould is properly held in place and parts are properly aligned before manufacturing starts.
  - Operate machines to manufacture lenses.
  - Maintain and clean the mould after lenses are manufactured.
  - Set up batches of finished lenses for shipment.
  - Distribute lenses to customers.
  - Administer and manage all processes at Plastim.
- By defining activities and identifying the costs of performing each activity, ABC systems seek a greater level of detail in understanding how an organization uses its resources





# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 1: Identify the chosen cost objects.** The cost objects are the S3 and CL5 lenses. Plastim's goal is to first calculate the total costs of manufacturing, and distributing these lenses and then the per-unit costs.
- **Step 2: Identify the direct costs of the products.** Plastim identifies direct materials costs, direct manufacturing labour costs, and mould-cleaning and maintenance costs as direct costs of the lenses. [Note that because mould-cleaning and maintenance costs consist of worker's wages for cleaning moulds after each batch of lenses is produced, cleaning and maintenance costs are direct batch -level costs.] Plastim's direct costs are as follows:

Description	Cost hierarchy category	60 000 Simple lenses (S3)		15 000 Complex lenses (CL5)		Total (3) = (1) + (2)
		Total (1)	Per unit	Total (3)	Per unit	
Direct materials	Output-unit level	€ 1 125 000	€ 18.75	€ 675 000	€ 45.00	€ 1 800 000
Direct labour	Output-unit level	600 000	10.00	195 000	13.00	795.000
Cleaning and maintenance	Batch level	120 000	2.00	150 000	10.00	270.000
Total direct costs		€ 1.845.000	€ 30.75	€ 1 020 000	€ 68.00	€ 2 865 000



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 3: Select the cost-allocation bases to use for allocating indirect costs to the products.** Plastim identifies six activities – design, moulding machine set-ups, manufacturing operations, shipment set-up, distribution and administration – for allocating indirect costs to products. The cost-allocation base and the quantity of the cost-allocation base for each activity:

Activity	Cost hierarchy category	Quantity of cost-allocation base	Brief explanation of the cause-and-effect relationship that motivates the choice of the allocation base
Design	Product-sustaining	100 parts-square metres	Complex moulds (more parts and larger surface area) require greater Design Department resources
Set-ups of moulding machines	Batch level	2000 set-up-hours	Overhead costs of the set-up activity increase as set-up- hours increase
Manufacturing operations	Output-unit level	12 750 moulding machine- hours	Plastim has mostly automated moulding machines. Manufacturing overhead costs support automated moulding machines and hence increase with moulding machine usage
Shipment set-up	Batch level	200 ship-ments	Costs incurred to prepare batches for shipment increase with the number of shipments
Distribution	Output-unit level	67 500 cubic metres	Overhead costs of the distribution activity increase with cubic metres of packages shipped
Administration	Facility-sustaining	39 750 direct manufacturing labour-hours	Administration Department resources support direct manufacturing labour-hours because the demand for these resources increases with direct manufacturing labour-hours



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 4: Identify the indirect costs associated with each cost-allocation base.** In this step, overhead costs incurred by Plastim are assigned to activities, to the extent possible, on the basis of a cause-and-effect relationship between the costs of an activity and the cost-allocation base for the activity.

Activity	Cost hierarchy category	Total costs	Brief explanation of the cause-and-effect relationship that motivates the choice of the allocation base
Design	Product-sustaining	€ 450 000	Complex moulds (more parts and larger surface area) require greater Design Department resources
Set-ups of moulding machines	Batch level	€ 300 000	Overhead costs of the set-up activity increase as set-up- hours increase
Manufacturing operations	Output-unit level	€ 637 500	Plastim has mostly automated moulding machines. Manufacturing overhead costs support automated moulding machines and hence increase with moulding machine usage
Shipment set-up	Batch level	€ 81 000	Costs incurred to prepare batches for shipment increase with the number of shipments
Distribution	Output-unit level	€ 391 500	Overhead costs of the distribution activity increase with cubic metres of packages shipped
Administration	Facility-sustaining	€ 255 000	Administration Department resources support direct manufacturing labour-hours because the demand for these resources increases with direct manufacturing labour-hours



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 5: Compute the rare per unit of each cost-allocation base used to allocate indirect costs to the products.**

Activity (1)	Cost hierarchy Category (2)	Total costs (3)	Quantity of cost-allocation base (4)	Overhead allocation rate (5)=(3)÷(4)
Design	Product-sustaining	€ 450 000	100 parts-square metres	€ 4500 per parts-square metres
Set-ups of moulding machines	Batch level	€ 300 000	2000 set-up-hours	€ 150 per set-up-hour
Manufacturing operations	Output-unit level	€ 637 500	12 750 moulding machine-hours	€ 50 per Moulding machine-hour
Shipment set-up	Batch level	€ 81 000	200 shipments	€ 405 per shipment
Distribution	Output-unit level	€ 391 500	67 500 cubic metres	€ 5.80 per cubic metre
Administration	Facility-sustaining	€ 255 000	39 750 direct manufacturing labour-hours	€ 6.4151 per direct manufacturing labour-hour



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 6: Compute the indirect costs allocated to the products.**

Description of Cost and the Quantity of Activity Used by Each Type of Lens	60 000		15 000		Total (3)=(1)+(2)
	Simple lenses (S3) Total (1)	Per unit	Complex lenses (CL5) Total (2)	Per unit	
<b>Design activity costs</b>					
S3, 30 parts-square metres x € 4500	135 000	2.25			
CL5, 70 parts-square metres x € 4500			315 000	21.00	450 000
<b>Set-up activity costs</b>					
S3500 set-up hours x € 150	75 000	1.25			
CL5, 1500 set-up- hours x € 150			225 000	15.00	300 000
<b>Manufacturing operations activity costs</b>					
S3, 9000 moulding machine-hours x € 50	450 000	7.50			
CL5, 3750 moulding machine-hours x € 50			187 500	12.50	637 500
<b>Shipping set-up activity</b>					
S3, 100 shipments x € 405	40 500	0.67			
CL5, 100 shipments x € 405			40 500	2.70	81 000
<b>Distribution activity</b>					
S3, 45 000 cubic metres x €5.80	261 000	4.35			
CL5, 22 500 cubic metres x €5.80			130 500	8.70	391 500
<b>Administration activity</b>					
S3, 30 000 direct manu facturing labour-hours x €6.4151	192 453	3.21			
CL5, 9750 direct manu facturing labour-hours x €6.4151			62 547	4.17	255 000
<b>Total indirect costs</b>	<b>1 153 953</b>	<b>19.23</b>	<b>961.047</b>	<b>64.07</b>	<b>2 115 000</b>



# ABC Compared with Traditional Costing: Example – Activity Based Costing System

- **Step 7: Compute the total costs of the products by adding all direct and indirect costs assigned to them.**

Description of Cost and the Quantity of Activity Used by Each Type of Lens	60 000		15 000		Total
	Simple lenses (S3)		Complex lenses (CL5)		(3)=(1)+(2)
	Total (1)	Per unit	Total (2)	Per unit	
<b>Direct costs</b>					
Direct materials	€ 1 125 000	€ 18.75	€ 675 000	€ 45.00	€ 1 800 000
Direct manufacturing labour	600 000	10.00	195 000	13.00	795.000
Direct mould-cleaning and maintenance costs	120 000	2.00	150 000	10.00	270 000
<b>Indirect costs</b>	1 153 953	19.23	961.047	64.07	2 115 000
<b>Total costs</b>	€ 2 998 953	€ 49.98	€ 1 981 047	€ 132.07	€ 4 980 000



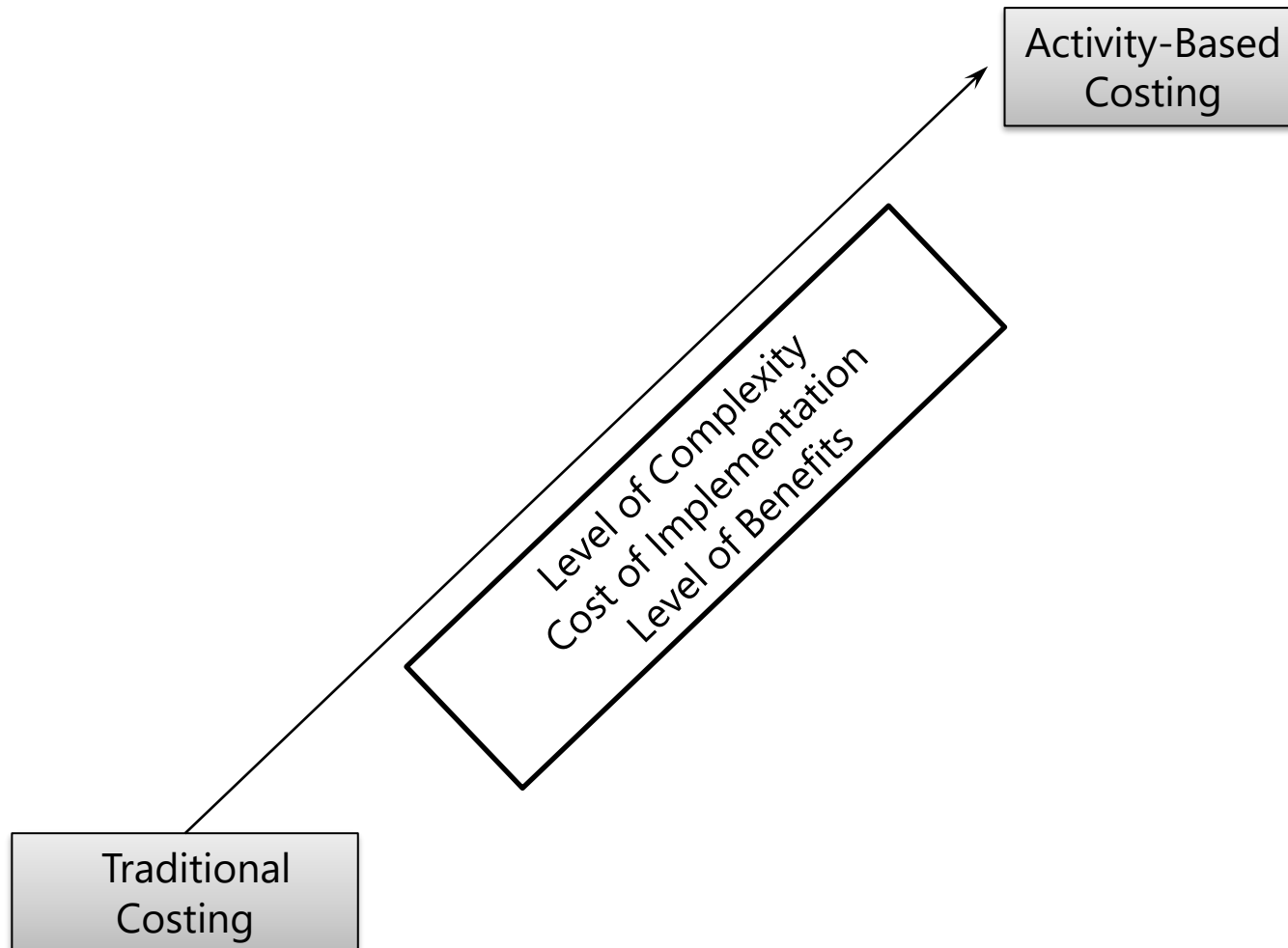
# ABC Compared with Traditional Costing: Example – Compare and Contrast

- **Step 7: Compute the total costs of the products by adding all direct and indirect costs assigned to them.**

	Single indirect-cost pool system (1)	ABC System (2)	Difference (3)=(2) – (1)
Direct-cost categories	Direct materials Direct manufacturing labour	Direct materials Direct manufacturing labour Direct cleaning and maintenance labour	
<b>Total direct costs</b>	<b>€2 595 000</b>	<b>€2 865 000</b>	<b>€270 000</b>
Indirect-cost pools	Single indirect-cost pool allocated using direct manufacturing labour-hours	1. Design cost pool allocated using parts-square metres Moulding machine set-up-cost pool allocated using 2. set-up-hours 3. Manufacturing operations-cost pool allocated using machine-hours 4. Shipment set-up-cost pool allocated using number 5. of shipments 6. Distribution-cost pool allocated using cubic metres of packages shipped 7. Administration-cost pool allocated using direct manufacturing labour-hours	
<b>Total indirect costs</b>	<b>€2 385 000</b>	<b>€2 115 000</b>	<b>(€270 000)</b>
Total costs assigned to simple (S3) lens	€3 525 000	€2 998 953	(€526 047)
Cost per unit of simple (S3) lens	€58.75	€49.98	(€8.77)
Total costs assigned to complex (CL5) lens	€1 455 000	€1 981 047	€526 047
Cost per unit of complex (CL5) lens	€97.00	€132.07	€35.07



# ABC Compared with Traditional Costing







# ABC– Benefits and Limitations

- **Benefits:**

- More accurate and informative product costs lead to better pricing decisions.
- The activities driving costs are more accurately measured.
- Managers gain easier access to the relevant costs.

- **Limitations:**

- An ABC system is very expensive to develop and implement, and very time-consuming to maintain.



# When Should a Company Use ABC?

- Indirect costs are significant in proportion to direct costs.
- Goods are complex, requiring many inputs and processes.
- Complex, low-volume products are profitable while standard, high-volume products are not.
- Different departments believe costs are assigned inaccurately.
- The company loses bids it thought were low, and wins bids it thought were high.
- Operations have changed significantly, but the costing system has not changed.
- Introduction of new models result in higher sales, apparent profits per unit, but an overall income decline.