Basics of Cost Accounting – Product Costing

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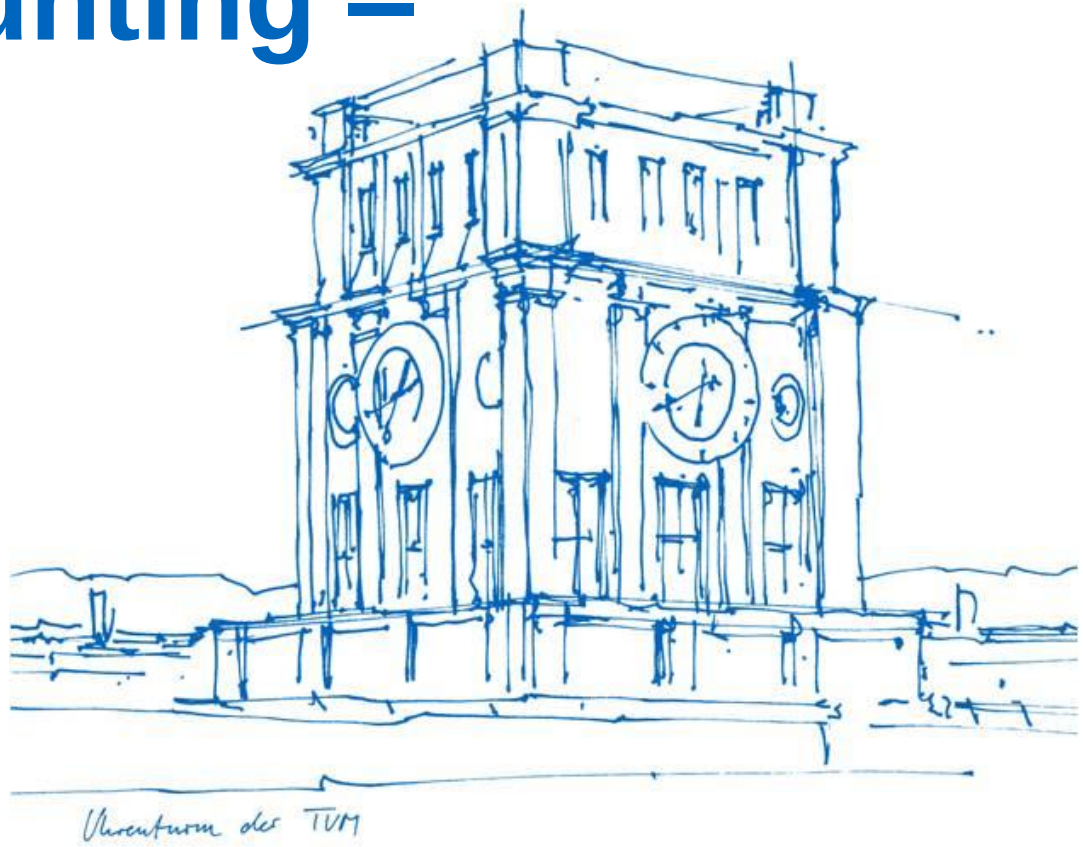


Outline of the course

Basics of Cost Accounting – Product Costing

1. Introduction to cost accounting
2. Cost-type accounting
3. Cost-center accounting
4. Product and service costing

Module 1. Introduction to cost accounting

Module 1. Introduction to cost accounting

Welcome to the course 'Cost Accounting'

Introduction and course outline

Source: https://www.press.bmwgroup.com

Module 1. Introduction to cost accounting

Cost accounting as a part of corporate accounting

Cost accounting and corporate management

Cost accounting and corporate management

Cost accounting	supports the management of a company by providing information necessary for managing the entire company or individual departments

- Cost accounting **provides information** for…

Module 1. Introduction to cost accounting

Cost accounting as a part of corporate accounting

Cost accounting, management accounting, and financial accounting

Cost accounting as part of corporate accounting

Accounting system	Financial accounting including balance-sheet accounting and cash-flow statements
	Capital budgeting
	Management accounting together with cost accounting

Management accounting vs. financial accounting

	Management accounting	Financial accounting
Addressees of the information	Members of the company	External parties
Accounting objectives	Planning, management, control and decision-making	Presentation of wealth-, financial position and income situation; calculation of dividend payouts and taxes
Rules of measurement	Hardly any specifications	US-GAAP, HGB, IFRS
Accounting object	Disaggregated accounts for parts of the company	Aggregated accounts for segments and the company as a whole
Time span and frequency	Variable (daily, weekly, monthly or annual reports)	Fixed (annual, half-yearly and quarterly reports)
Focus	Future- and past-oriented	Past-oriented

Cost accounting vs. capital budgeting

	Forecast	Time value of money
Cost accounting	Up to one year for operational decisions	Neglected
Capital budgeting	Long-term effects of decisions	Important

Module 1. Introduction to cost accounting

Basic concepts of cost accounting

Definition of costs

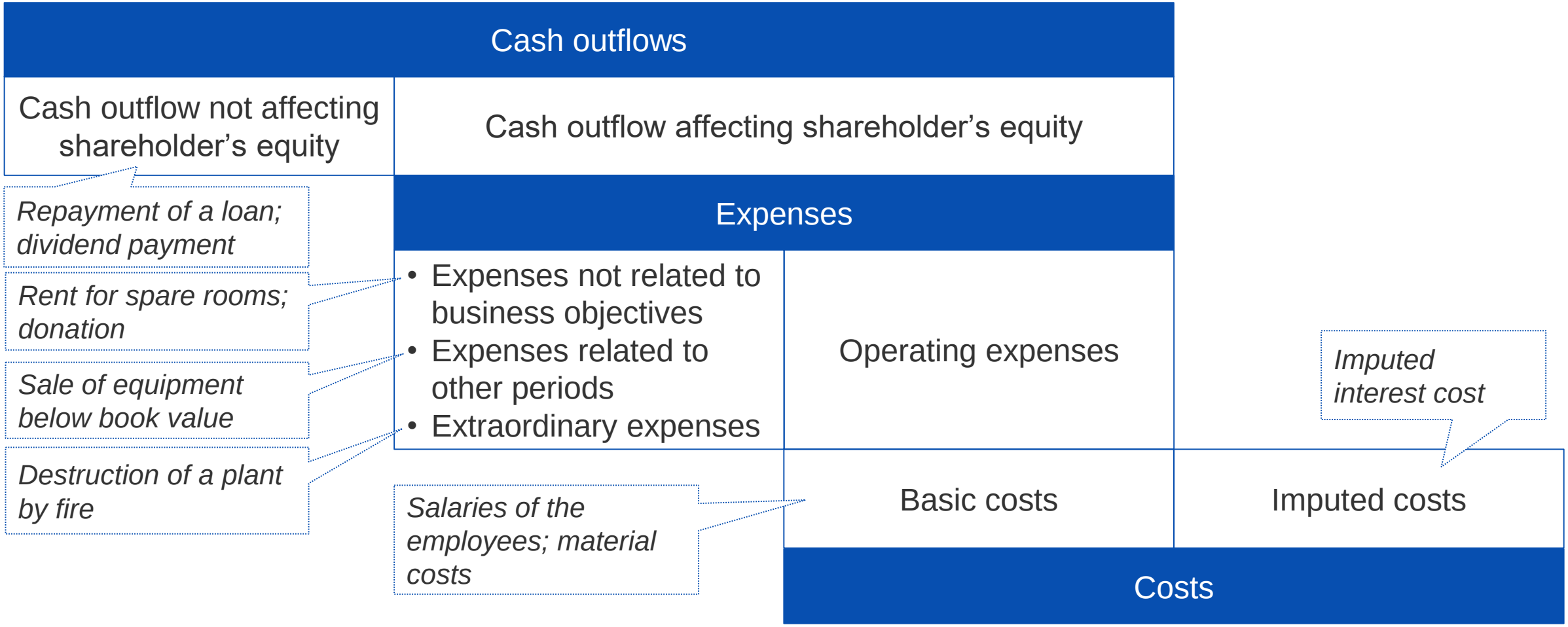
Costs and Revenues

Costs	are valuated consumption of resources
Revenues	are valuated production of goods

Three conceptual elements contained in the definition of costs and revenues:

1. Objective orientation
2. Valuation
3. Consumption of resources or production of goods

Costs, expenses, cash outflows



Module 1. Introduction to cost accounting

Basic concepts of cost accounting

Cost terms and their meaning: Total and unit costs, direct and indirect costs, fixed and variable costs

Cost terms and their meaning

1. **Reference**
   - Total costs
   - Unit costs
2. **Cost assignment**
   - Direct costs
   - Indirect costs
   - Artificial indirect costs
3. **Cost behavior**
   - Fixed costs
   - Variable costs

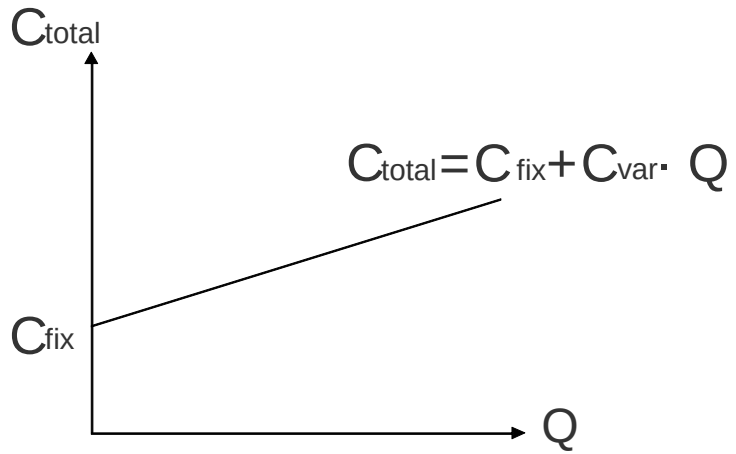
1 Total costs and unit costs

Total costs	Costs that relate to all goods produced within a given period
Unit costs	Costs of a single unit of a particular good

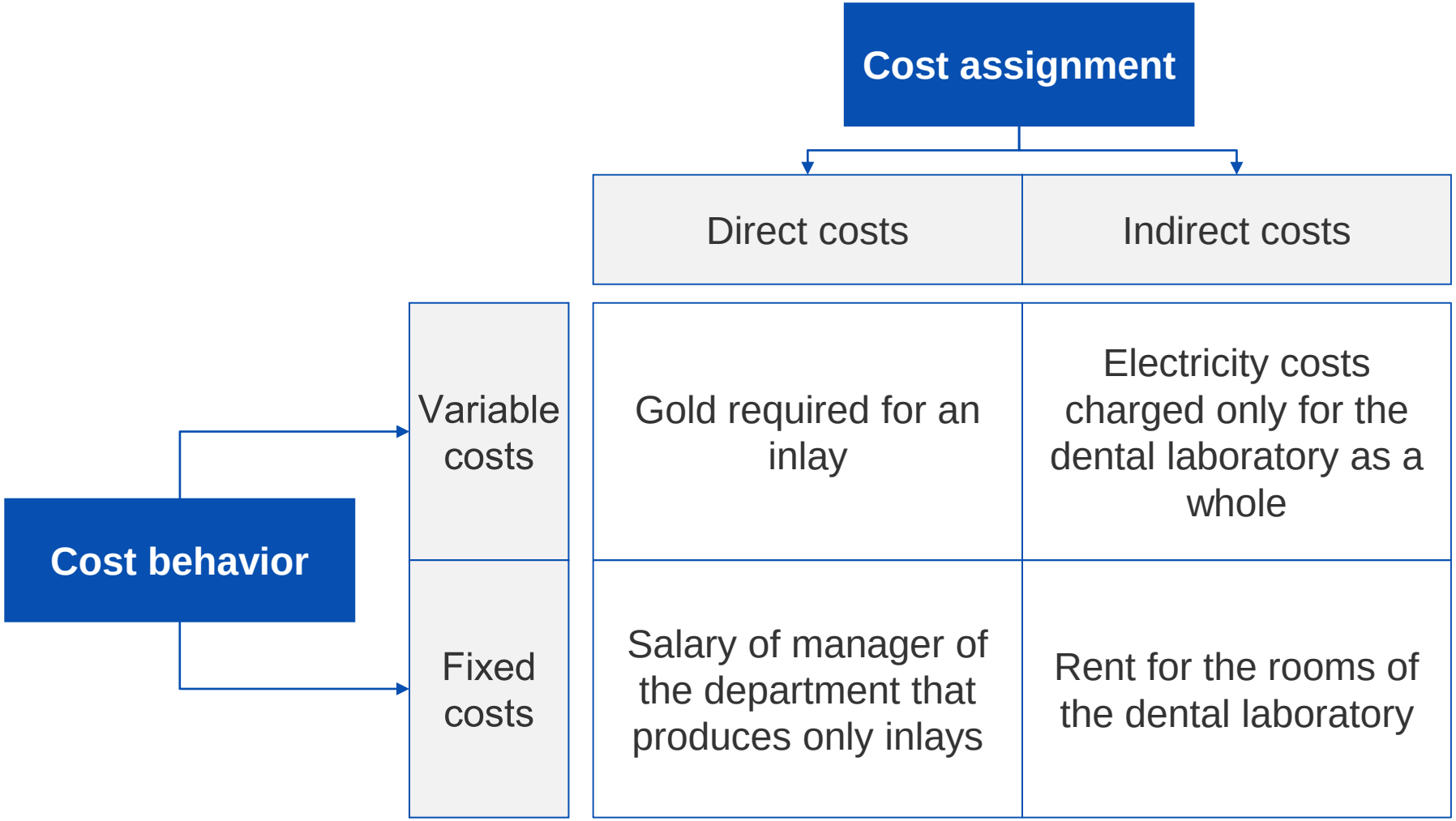
2 Direct costs and indirect costs

Direct costs	Costs that can be traced directly to a cost object (caused by one cost object)
Indirect costs	Costs that cannot be assigned directly to a cost object (caused jointly by several cost objects)
Artificial indirect cost	Costs that could in principal be traced directly to a cost object. However, comparing costs and benefits, companies do not trace them to cost objects

3 Variable costs and fixed costs

Variable costs	Costs that change when the quantity of a cost driver changes
Fixed costs	Costs that remain constant when the quantity of a cost driver changes
Relationship to total costs	

2 3 Direct, indirect, fixed and variable costs



Cost object: all inlays produced

Module 1. Introduction to cost accounting

Basic concepts of cost accounting

Cost terms and their meaning: Inventoriable and period costs, opportunity and sunk costs

Inventoriable costs and period costs

Inventoriable costs	Costs assigned to a particular product unit
Period costs	Costs that cannot be capitalized, i.e., they cannot be considered an asset in the balance sheet

Opportunity costs and sunk costs

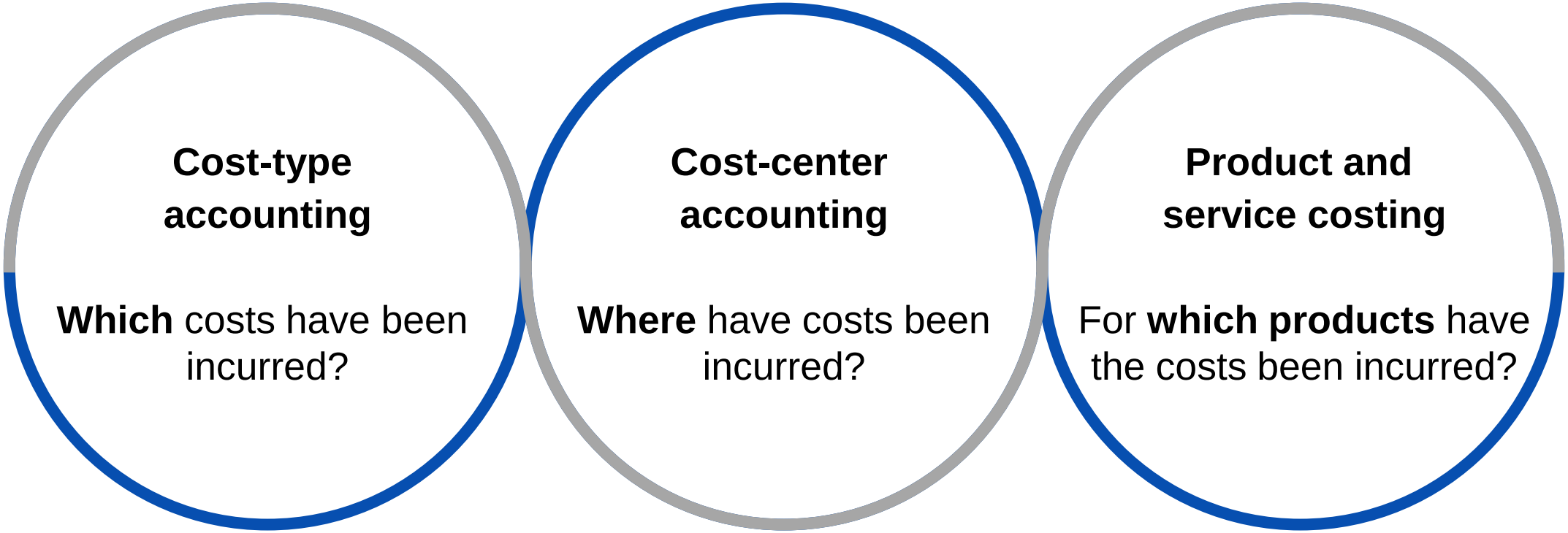
Opportunity costs	Contributions to a company’s profit that is foregone by choosing a decision alternative over the next-best alternative
Sunk costs	Costs that were caused in the past and can no longer be changed by current decisions

Module 1. Introduction to cost accounting

Basic concepts of cost accounting

The three sub-systems of cost accounting

Three sub-systems of cost accounting



Module 1. Introduction to cost accounting

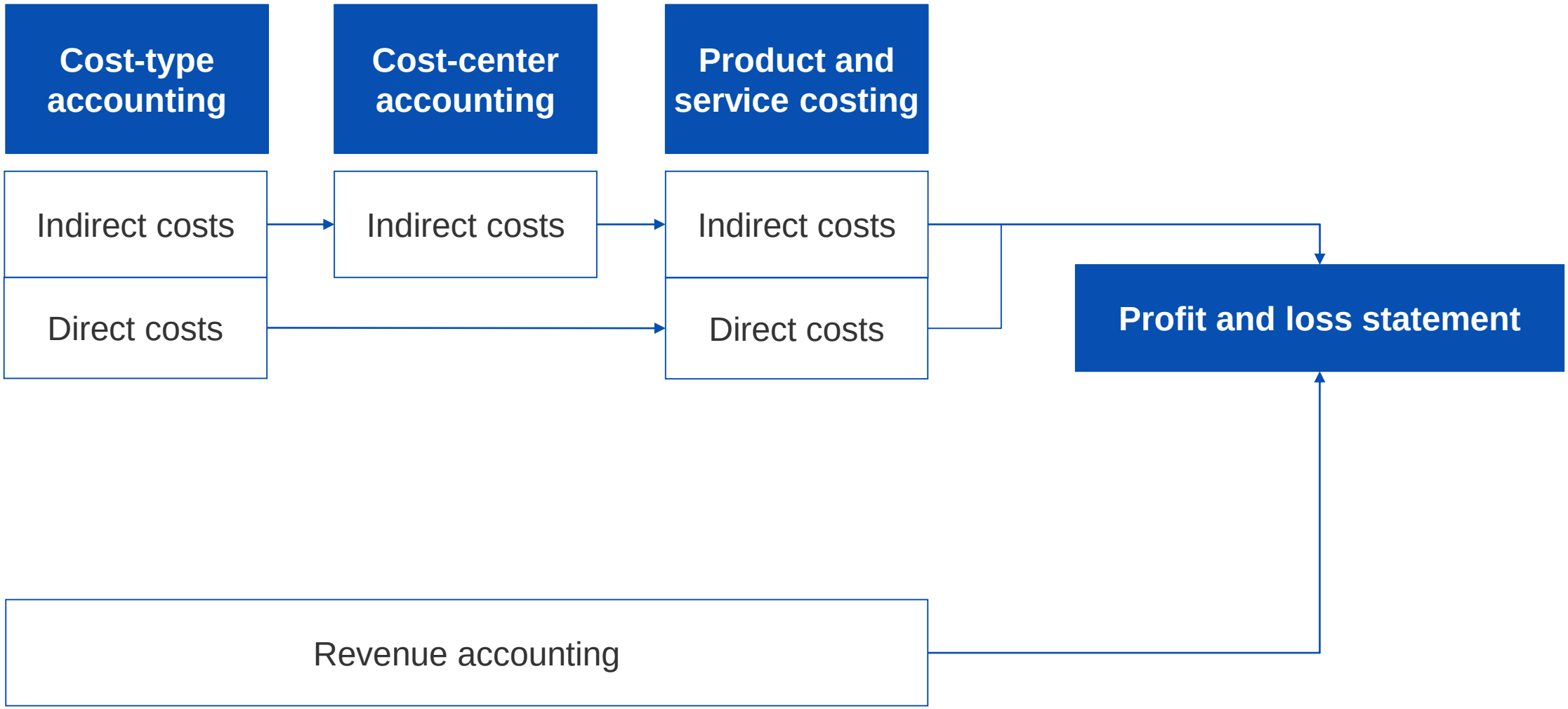
Basic concepts of cost accounting

Absorption costing versus variable costing

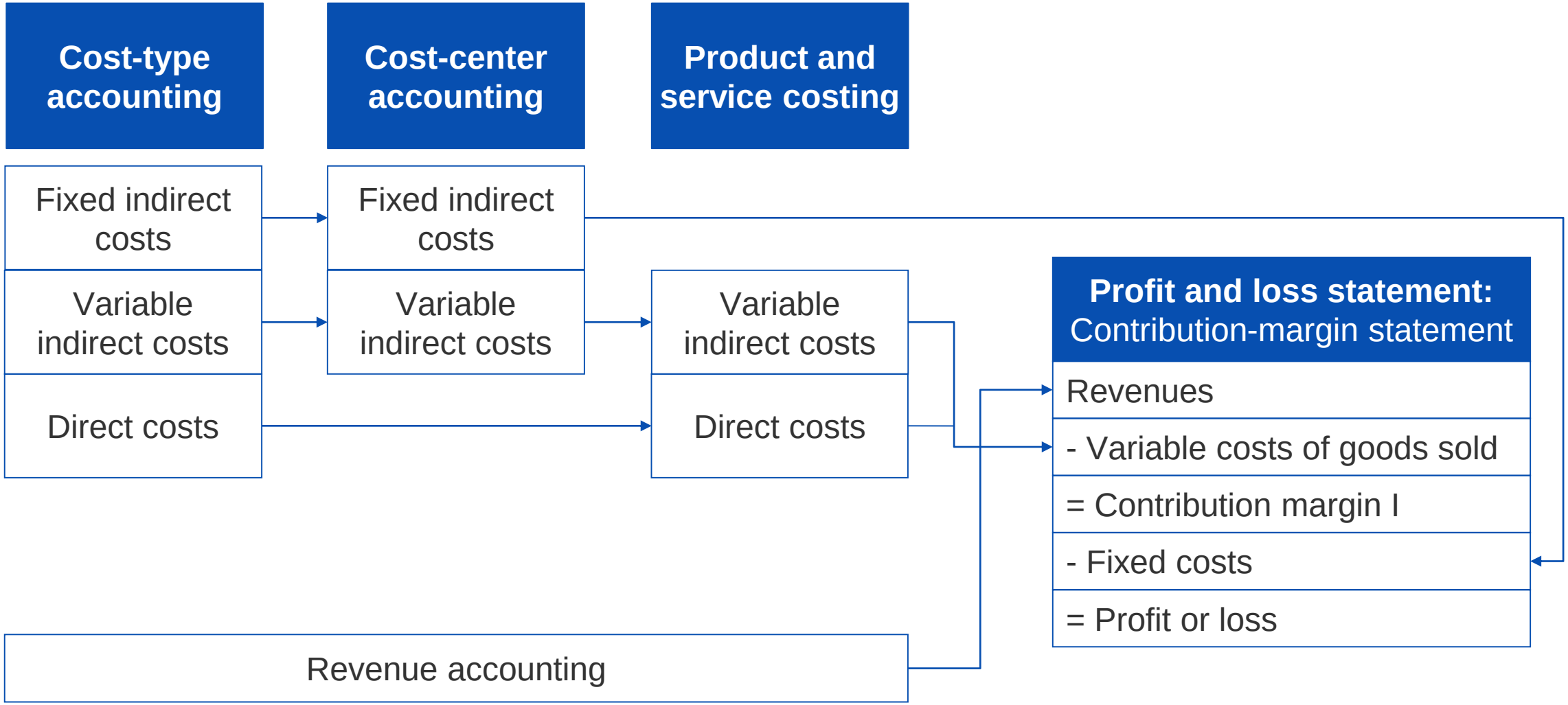
Absorption costing and variable costing

Absorption costing	Product units are valued at full costs	1
Variable costing	Product units are valued at variable costs	2

1 Absorption costing



2 Variable costing



Module 2. Cost-type accounting

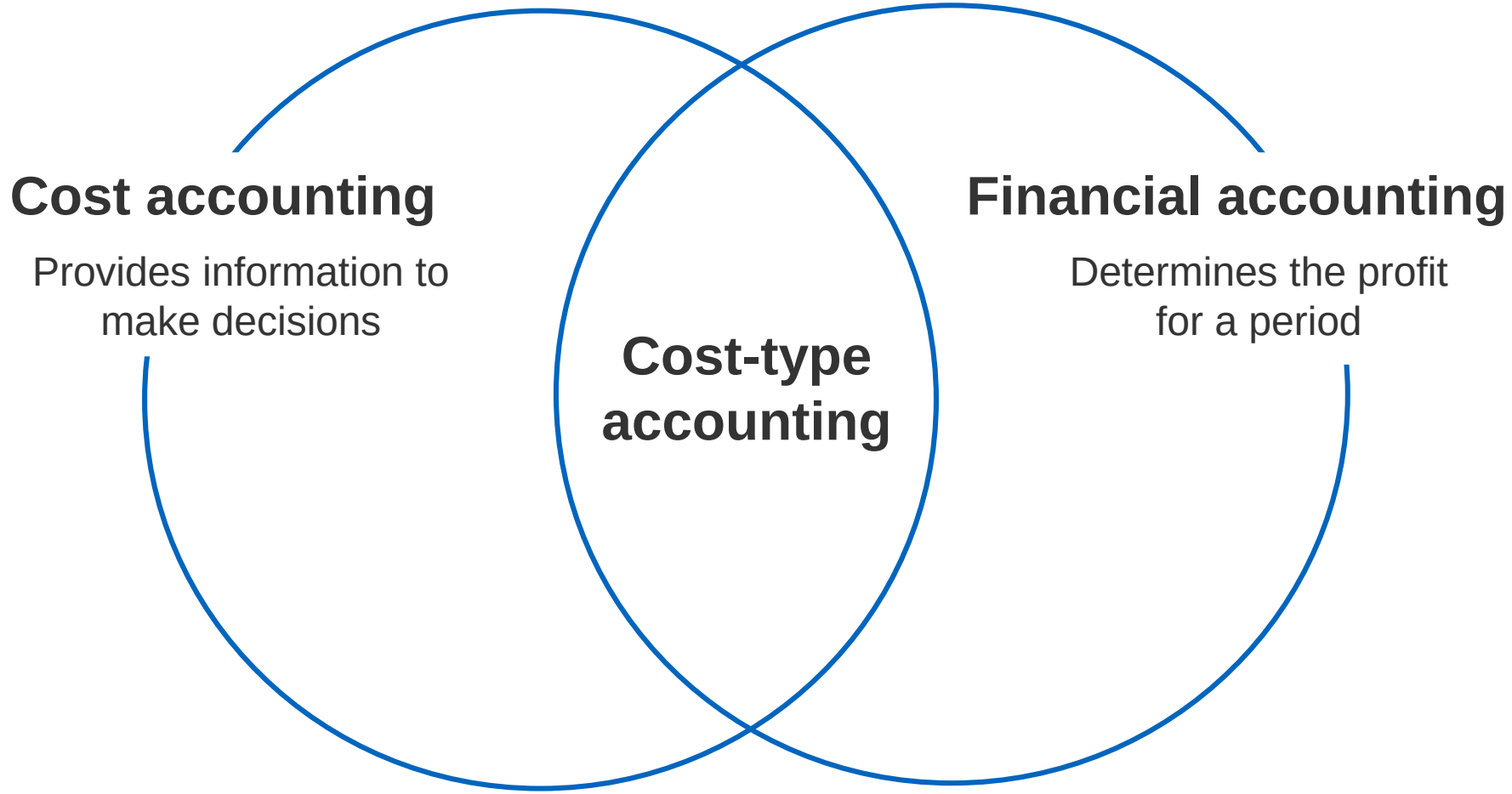
Module 2. Cost-type accounting

Introduction to cost-type accounting

Tasks of cost-type accounting, linkage to financial accounting, and important cost types

Tasks of cost-type accounting

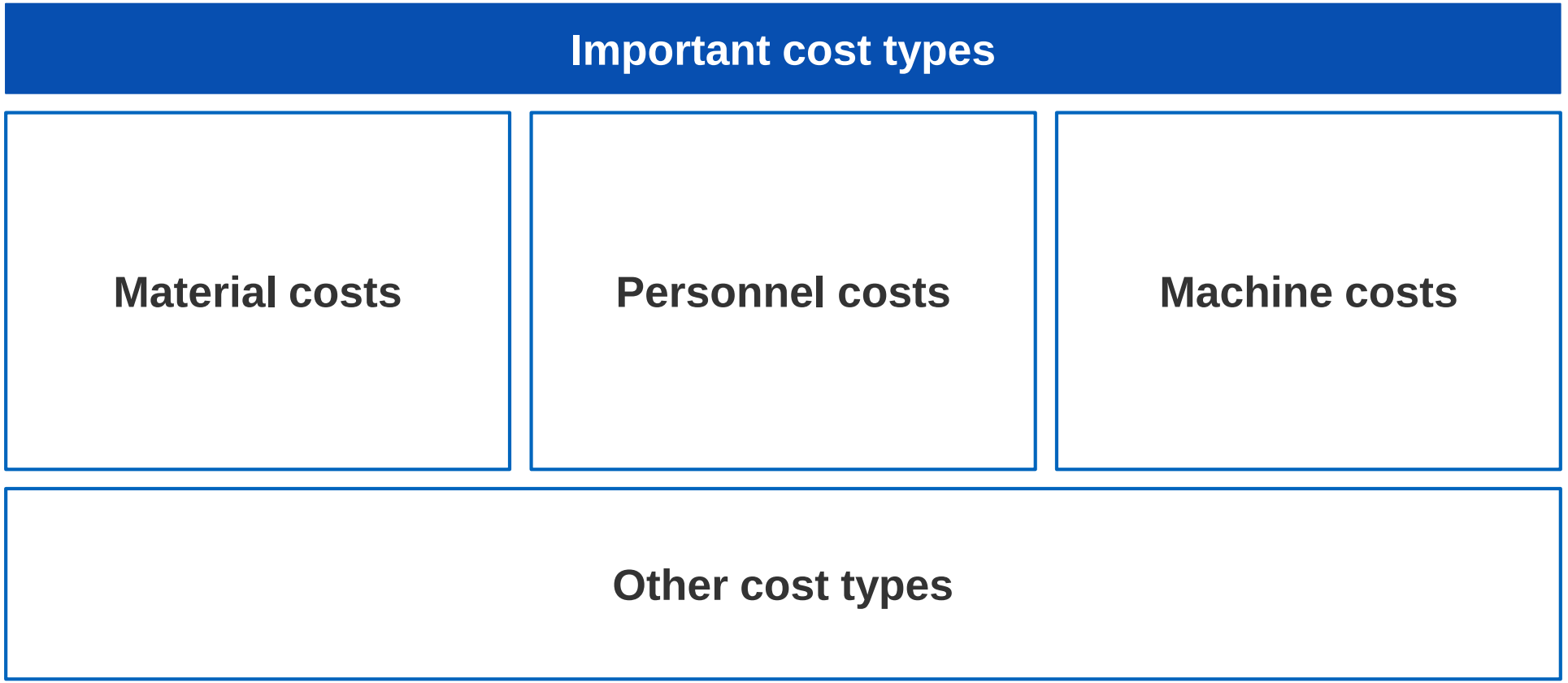
Cost-type accounting and financial accounting



Classification of cost types

Classification criterion	Examples
Nature of the input goods	Material costs, personnel costs, machine costs (depreciation, interest), costs for external services
Attributability of costs	Direct costs, indirect costs
Dependence on output variation	Variable costs, fixed costs
Position in value chain	Research and development costs, procurement costs, manufacturing costs, selling and shipping costs, administrative costs
Origin of the input goods	Primary costs, secondary costs

Important cost types



Module 2. Cost-type accounting

Material costs

Introduction to material costs

Important types of materials

Material type	Example	Attributability
Raw materials	Wood, water	Direct costs
Auxiliary materials	Paints, adhesives	Artificial indirect costs
Operating materials	Oils, greases	Indirect costs

Methods for recording and valuing material consumption

Material costs	= quantity · price

Methods for **recording** material consumption	Inventory method
	Carrying-on method
	Retroactive accounting method

Methods for **valuing** material consumption	First In First Out (FIFO)
	Last In First Out (LIFO)
	Ex-post average prices
	Moving average prices

Module 2. Cost-type accounting

Material costs

Recording material consumption

Introductory example

https://www.siemensgamesa.com/en-int/products-and-services

Situation

Cable ducts are needed to produce wind turbines

Task

Determine the consumption of cable ducts for one month

Methods for recording material consumption

Material costs	= quantity · price

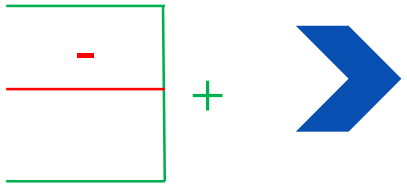
Methods for **recording** material consumption		Methods for **valuing** material consumption
	Inventory method 1	First In First Out (FIFO)
	Carrying-on method 2	Last In First Out (LIFO)
	Retroactive accounting method 3	Ex-post average prices
		Moving average prices

1 Inventory method

Consumption	= beginning inventory + acquisitions – ending inventory

Example:

Beginning inventory (1.5.): 500 units
Ending inventory (31.5.): 760 units
Acquisitions (May): 1,500 units



Consumption (May):
1,240 units

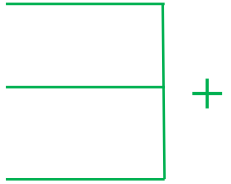
Example based on fictitious values.

2 Carrying-on method

Consumption	Directly recorded (consumption slip)

Example:

Consumption slip project 1 (4.5.): 400 units
Consumption slip project 2 (17.5.): 600 units
Consumption slip project 3 (24.5.): 200 units



Consumption (May):
1,200 units

Example based on fictitious values.

3 Retroactive accounting method

Consumption	Calculated based on the bills of materials for each product

Example:

Bill of material for one wind turbine: 1 tower, 3 rotor blades

Example based on fictitious values.

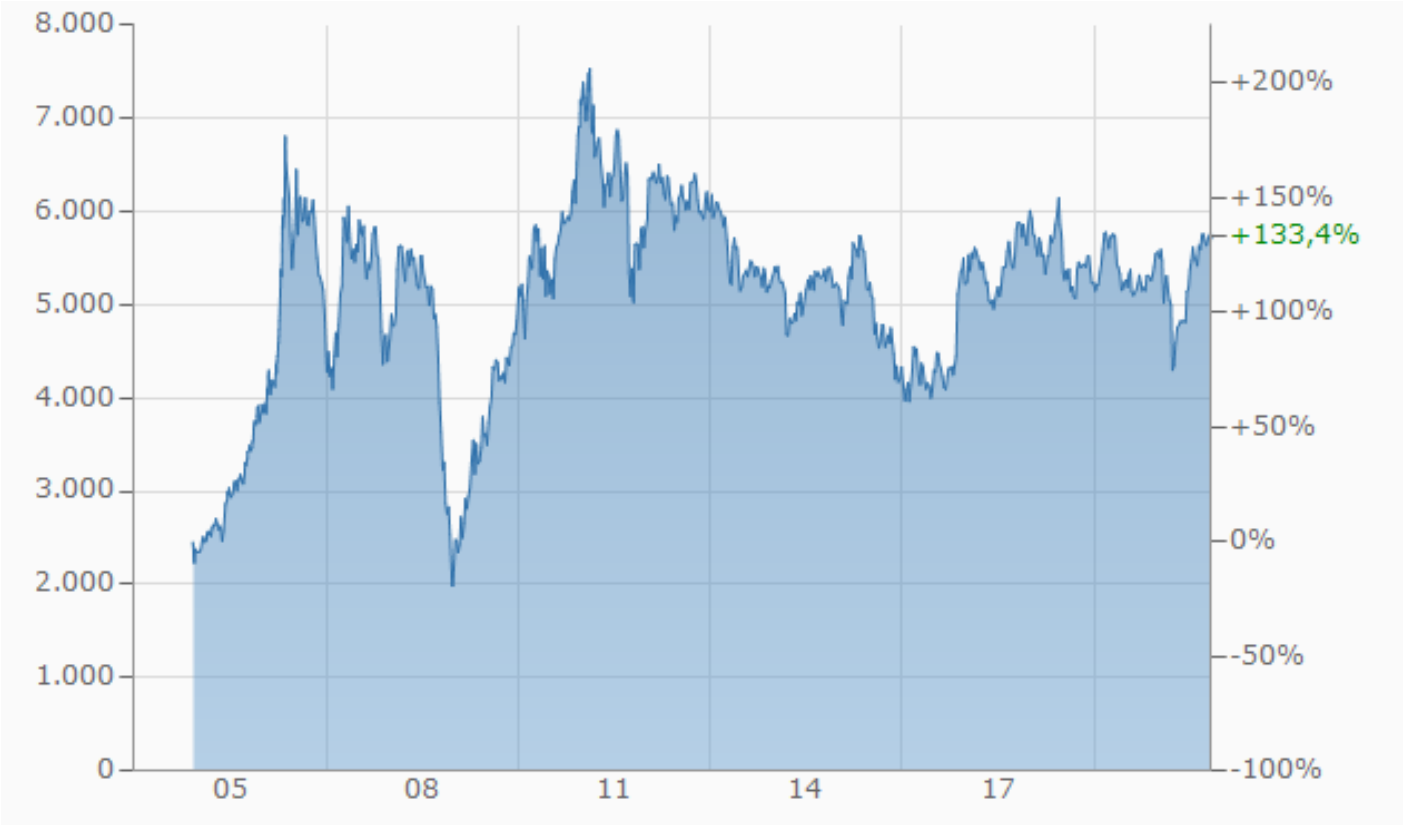
Module 2. Cost-type accounting

Material costs

Valuing material consumption

Introductory example

Copper price in Euro



https://www.finanzen.net/rohstoffe/kupferpreis

Situation

Copper is an important material in the production of wind turbines

Task

Determine the value of copper consumption during an accounting period

Methods for recording and valuing material consumption

Material costs	= quantity · price

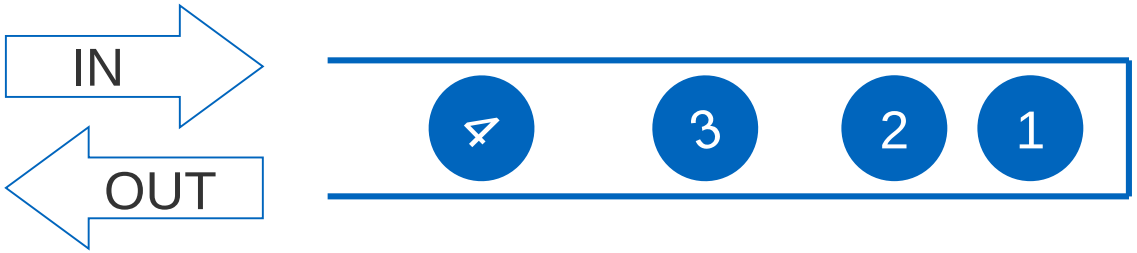
Methods for **recording** material consumption	
	Inventory method
	Carrying-on method
	Retroactive accounting method

Methods for **valuing** material consumption		
	First In First Out (FIFO)	1
	Last In First Out (LIFO)	2
	Ex-post average prices	3
	Moving average prices	4

FIFO and LIFO

1. **FIFO** method assumes that material delivered *first* is consumed *first*

2. **LIFO** method assumes that material delivered *last* is consumed *first*



FIFO and LIFO

Example: Copper consumption

- Inventory: 500 kg valued at €7.50 per kg
- Copper price is fluctuating

Date	Event	Quantity [kg]	Price [€/kg]
01.10.	inflow	1,000	6.00
06.10.	outflow	800	
20.10.	outflow	500	
28.10.	inflow	1,800	4.50
10.11.	outflow	900	
27.11.	outflow	700	
15.12.	inflow	1,200	3.00
22.12.	outflow	500	

FIFO-method [€]

Beginning inventory	3,750	outflow 06.10.	5,550
inflow 01.10.	6,000	outflow 20.10.	3,000
inflow 28.10.	8,100	outflow 10.11.	4,350
inflow 15.12.	3,600	outflow 27.11.	3,150
		outflow 22.12.	2,100
		Ending inventory	3,300
	21,450		21,450

LIFO-method [€]

Beginning inventory	3,750	outflow 06.10.	4,800
inflow 01.10.	6,000	outflow 20.10.	3,450
inflow 28.10.	8,100	outflow 10.11.	4,050
inflow 15.12.	3,600	outflow 27.11.	3,150
		outflow 22.12.	1,500
		Ending inventory	4,500
	21,450		21,450

Ex-post and moving average price method

3 **Ex-post average price method** uses average purchase price for all the consumed material at the end of an accounting period

4 **Moving average price method** uses the average price after each material consumption based on total inventory at that time

Module 2. Cost-type accounting

Personnel costs

Personnel costs

Personnel costs

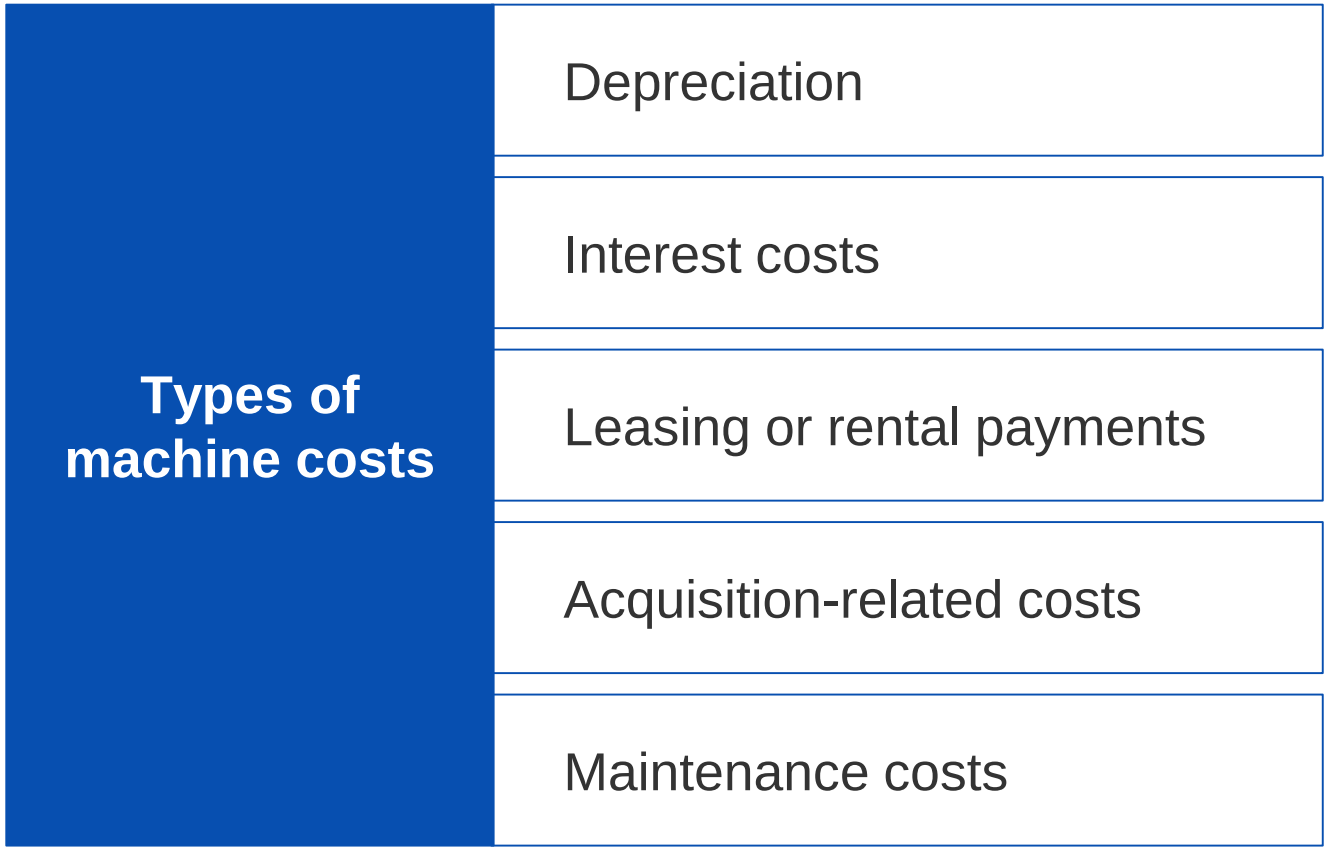
Types of personnel costs
Salaries
Time wages
Piece-rate wages
Premium wages
Fringe benefits

Module 2. Cost-type accounting

Machine costs

Types of machine costs

Types of machine costs



Module 2. Cost-type accounting

Machine costs

Depreciation

Introductory example

https://www.maz-online.de/Lokales/Potsdam-Mittelmark/Niemegk/Windpark-in-Niederwerbig-Alle-Infos-zum-Baubeginn

Situation

For the transport of individual components of the wind turbines a heavy duty transporter is needed

Problem statement

Determine the depreciation of a heavy duty transporter

Depreciation: Task and methods

Depreciation	spreads the purchase price over the years of use of the asset

Depreciation methods

- Time dependent
  - Straight-line depreciation (1)
  - Declining balance depreciation (2)
  - Arithmetic-degressive depreciation (3)
- Output dependent
  - Units of production depreciation (4)

1 Straight-line depreciation

- Most important time-dependent method
- Constant amount of periodic depreciation

Amount of periodic depreciation (a):

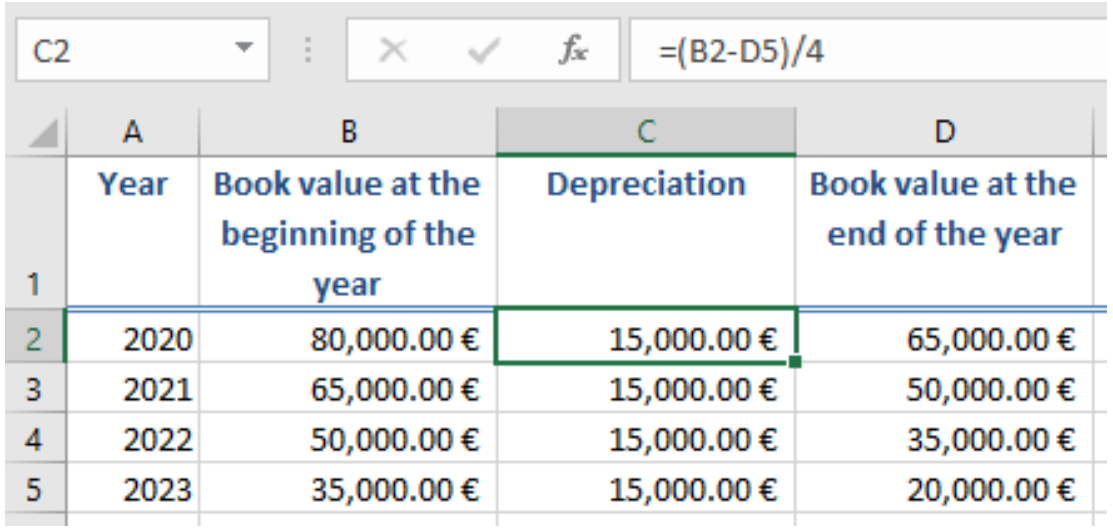
$$a = \frac{(I - L)}{T}$$

with:

I acquisition value
L residual value
T useful life

Example: Depreciation of a truck

- Purchase price: €80,000
- Residual value: €20,000
- Usage over 4 years



	A	B	C	D
1	Year	Book value at the beginning of the year	Depreciation	Book value at the end of the year
2	2020	80,000.00 €	15,000.00 €	65,000.00 €
3	2021	65,000.00 €	15,000.00 €	50,000.00 €
4	2022	50,000.00 €	15,000.00 €	35,000.00 €
5	2023	35,000.00 €	15,000.00 €	20,000.00 €

2 Declining balance depreciation

- Time-dependent method
- Depreciation amounts decrease gradually over time

Depreciation percentage rate (p):

$$p = 1 - \sqrt[T]{\frac{L}{I}}$$

with:

I acquisition value

L residual value

T useful life

Example: Depreciation of a truck

- Purchase price: €80,000
- Residual value: €20,000
- Usage over 4 years

$$p = 1 - \sqrt[4]{\frac{€20{,}000}{€80{,}000}} = 0.293$$

C2 =B2*(1-($D$5/$B$2)^(1/4))

	A	B	C	D
1	Year	Book value at the beginning of the year	Depreciation	Book value at the end of the year
2	2020	80,000.00 €	23,431.46 €	56,568.54 €
3	2021	56,568.54 €	16,568.54 €	40,000.00 €
4	2022	40,000.00 €	11,715.73 €	28,284.27 €
5	2023	28,284.27 €	8,284.27 €	20,000.00 €

3 Arithmetic-degressive depreciation

- Time-dependent method
- Depreciation amounts decrease each year by a constant value

Depreciation percentage rate (d):

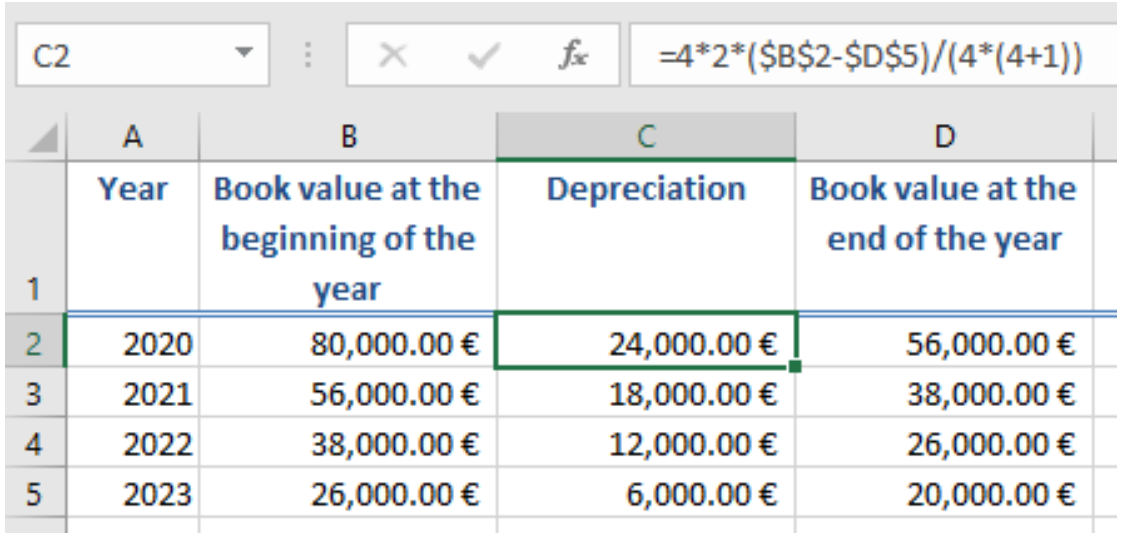
$$d = \frac{I - L}{1 + 2 + \ldots + T} \quad \text{or} \quad d = \frac{2\,(I - L)}{T\,(T + 1)}$$

with:

I acquisition value
L residual value
T useful life

Example: Depreciation of a truck

- Purchase price: €80,000
- Residual value: €20,000
- Usage over 4 years



	A	B	C	D
1	Year	Book value at the beginning of the year	Depreciation	Book value at the end of the year
2	2020	80,000.00 €	24,000.00 €	56,000.00 €
3	2021	56,000.00 €	18,000.00 €	38,000.00 €
4	2022	38,000.00 €	12,000.00 €	26,000.00 €
5	2023	26,000.00 €	6,000.00 €	20,000.00 €

4 Units of production depreciation

- Output dependent
- Based on the utilization of the asset

Depreciation amount per unit:

$$\frac{(I - L)}{\text{Total units of production}}$$

with:

I acquisition value

L residual value

Example: Depreciation of a truck

- Purchase price: €80,000
- Residual value: €20,000
- Usage over 4 years
- Running performace: 30k km (2020), 35k km (2021), 40k km (2022), 45k km (2023)

Depreciation amount per kilometer driven:
(€80,000 - €20,000) / 150,000 km = €0.4 per km

C2 | =30000*0.4

	A	B	C	D
1	Year	Book value at the beginning of the year	Depreciation	Book value at the end of the year
2	2020	80,000.00 €	12,000.00 €	68,000.00 €
3	2021	68,000.00 €	14,000.00 €	54,000.00 €
4	2022	54,000.00 €	16,000.00 €	38,000.00 €
5	2023	38,000.00 €	18,000.00 €	20,000.00 €

Module 2. Cost-type accounting

Machine costs

Interest costs

Interest costs

Interest costs	= capital required for operations · interest rate

Four steps of determining interest costs	1. Determine the assets necessary for operations
	2. Value the assets necessary for operations
	3. Determine the capital required for operations
	4. Determine the interest rate

Step 1: Determine the assets necessary for operations

Example: Interest costs for a wind turbine producer

Check the operational necessity for each position on the active side

Assets		
	FY	Previous year
Industrial property rights	40	10
Property with factory hall	1,100	1,150
Undeveloped property	400	430
Machinery	900	780
Investments in other companies	500	580
Inventories	4,500	4,200
Accounts receivable	7,000	6,400
Cash and cash equivalents	500	700
Total	14,940	14,250

Liabilities		
	FY	Previous year
Common stock	2,000	2,000
Additional paid in capital	450	450
Retained earnings	1,900	1,100
Current year´s earnings	2,690	2,170
Provisions	3,400	3,900
Loans	1,500	30
Revenues received in advance	0	1,200
Accounts payable	3,000	3,400
Total	14,940	14,250

Step 2: Value the assets necessary for operations

Example: Interest costs for a wind turbine producer

- Decision: Valuation based on replacement costs or acquisition and production costs
- Estimate average values of assets over the accounting year

	Assets		
	FY	Previous Year	Average
Industrial property rights	40	10	25
Property with factory hall	1,100	1,150	1,125
Undeveloped property	Not relevant for operations		
Machinery	900	780	840
Investments in other companies	Not relevant for operations		
Inventories	4,500	4,200	4,350
Accounts receivable	7,000	6,400	6,700
Cash and cash equivalents	500	700	600
Operating assets			13,640

Step 3: Determine the capital required for operations

Example: Interest costs for a wind turbine producer

- Deduct non-interest-bearing-liabilities (NIBL) from the operating assets
- Valuation based on average values

	FY	Previous year	Average
Operating assets			13,640
- Provisions	3,400	3,900	3,650
- Revenues received in advanced	0	1,200	600
- Accounts payable	3,000	3,400	3,200
Capital required for operations			6,190

Step 4: Determine the interest rate

Example: Interest costs for a wind turbine producer

Weighted Average Cost of Capital (WACC): $WACC = r_E \frac{E}{E+D} + r_D \frac{D}{E+D}(1-t)$

with:

E	Equity	r_D	Cost of debt
D	Debt	t	Tax rate
r_E	Cost of equity		

Capital Asset Pricing Model (CAPM): $r_E = r_f + \beta(r_m - r_f)$

with:

r_f	Risk-free interest rate
$r_m - r_f$	Market-risk premium
β	Beta-Factor; company risk faktor

Interest costs

Example: Interest costs for a wind turbine producer

Book value of the equity	Interest-bearing liabilities	Interest rate	Cost of equity
€7.04 million	€1.5 million	6%	$r_E = 0.05 + 1.2 \cdot 0.05 = 0.11$

- The tax rate is 35%, resulting in a weighted average cost of capital of

$$WACC = 0.11 \cdot \frac{7{,}040}{8{,}540} + 0.06 \cdot \frac{1{,}500}{8{,}540} \cdot (1 - 0.35) = 0.098$$

- Interest costs: 9.8% * €6.19 million = €607 thousand

Module 3. Cost-center accounting

Module 3. Cost-center accounting

Introduction to cost-center accounting

Tasks of cost-center accounting and structure of cost centers

Tasks of cost-center accounting

Structure of cost centers

Four basic requirements when defining cost centers	Homogeneity of cost drivers
	Matching of cost centers and the assignment of responsibilities
	Completeness and clarity
	Cost-benefit criterion

Two criteria when defining cost centers:

1. Depending on the business function of the departments
2. Depending on how costs are allocated

Categorization of cost centers

1. Definition of cost centers depending on the business function of the department

Energy	Building	Maintenance	Material
Manufacturing	Administration	Sales and distribution	

2. Definition of cost centers depending on how costs are allocated

Indirect cost centers	
Energy	Building
Maintenance	

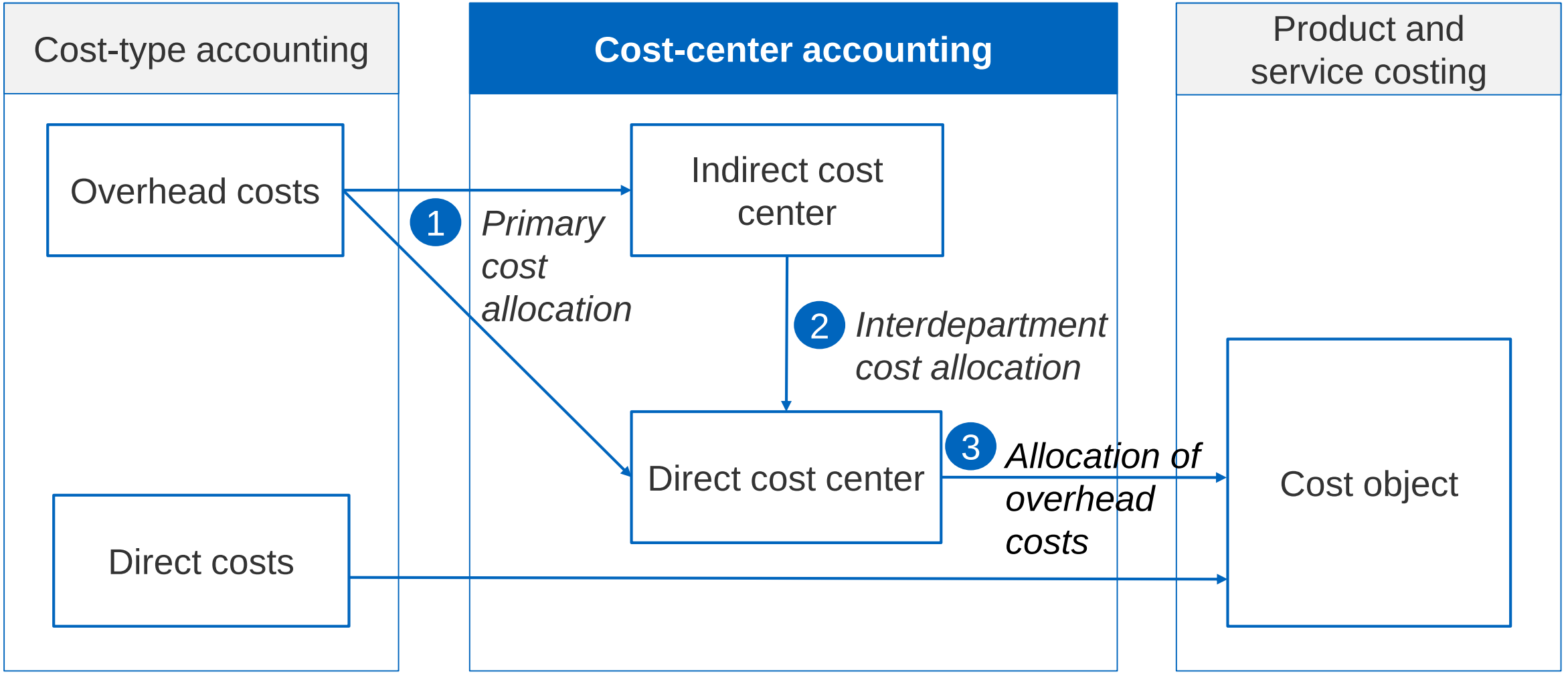
Direct cost centers	
Material	Manufacturing
Administration	Sales and distribution

Module 3. Cost-center accounting

Introduction to cost-center accounting

The three steps of cost-center accounting

The three steps of cost-center accounting



The cost allocation sheet

Cost types \ Cost center	Indirect cost center			Direct cost center			
	Energy	Property	Maintenance	Material	Production	Administration	Sales
Direct costs Direct costs type 1 … Direct costs type m							
Primary overhead costs Primary overhead costs type 1 … Primary overhead costs type n							
Secondary overhead costs Credit of indirect cost centers Debit of direct cost centers							
Total overhead cost							
Allocation base							
Overhead rate (= Total overhead cost / Allocation base)							

1 Allocation of direct and overhead costs to the cost centers

2 Interdepartment cost allocation

3 Allocation of overhead rates

Module 3. Cost-center accounting

Assignment of overhead costs to cost centers

Primary cost allocation

Task of primary cost allocation and types of primary costs

Task of primary cost allocation	Allocation of the costs as accurately as possible to those cost centers where the respective costs were incurred

Two types of primary costs:

Cost center direct costs	Costs that can be directly traced to one cost center (e.g. the salary of the head of the material warehouse)
Cost center indirect costs	Costs for which it is not possible to trace them directly to an unique cost center (e.g. salary of the employee responsible for material storage and production preparation)

Methods for allocating cost center indirect costs

Type of allocation base	Cost category	Allocation base
Quantity based	Room costs	Square meter or cubic meter
	Energy costs	Kilowatt hours
	…	….
Value based	Maintenance costs	Asset value
	Administrative expenses	Manufacturing costs
	….	….

Example

https://www.apple.com/de

Situation

A company that assembles and sells computers incurs overhead costs for salaries, auxiliary wages, depreciation and interest

Task

Allocate the overhead costs to the cost centers

Example

Amounts and allocation bases of overhead costs

Cost category	Total costs [€]	Distribution basis	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Salaries	454,000	directly attributable	3,600	16,800	20,000	12,000	162,000	153,600	86,000	454,000
Auxiliary wages	196,000	working hours [h]	100	300	3,000	4,000	6,000	200	400	14,000
Depreciation	360,000	directly attributable	4,000	42,000	34,000	40,000	190,000	25,600	24,400	360,000
Interest	300,000	invested capital [€]	100,000	3,700,000	2,400,000	3,200,000	16,400,000	1,800,000	2,400,000	30,000,000

Allocation rate for auxiliary wages

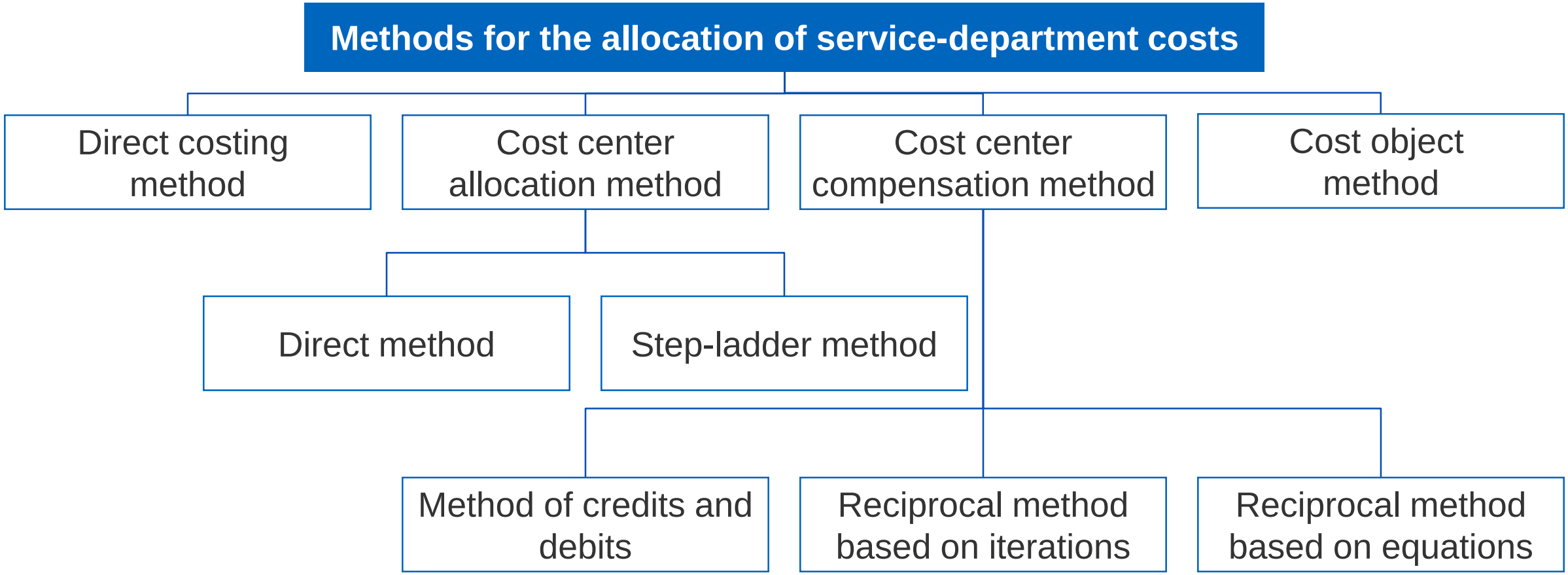
- Total amount of auxiliary wages = €196,000
- Total working hours (auxiliary wages) = 14,000 h ➤ Allocation base
- Allocation rate for auxiliary wages = €196,000/14,000 working hours = €14 per working hour

Module 3. Cost-center accounting

Methods for the allocation of service-department costs

Overview

Methods for the allocation of service-department costs



Module 3. Cost-center accounting

Methods for the allocation of service-department costs

Reciprocal method based on equations

General characteristics

Concept	Determination of transfer prices by solving a system of equations
Accuracy	Exact method
Recording effort	All internal exchanges of services
Transfer prices	Transfer prices (or total costs) must be recalculated periodically

	I1	I2	I3	D1	D2
Primary costs	X	X	X	X	X
Secondary cost					
Secondary cost					
Secondary cost					
Sum	0	0	0	>0	>0

Transfer price x Consumption

System of equations

System of equations with transfer prices as unknowns

- **One equation is formulated for each indirect cost center:**

$$q_j \; c_j = C_j + \sum_{i=1}^{n} q_{ij} \, c_i \qquad (\mathrm{j} = 1, \ldots, n)$$

under the condition

$$q_i = \sum_{j=1}^{n+m} q_{ij} \qquad (\mathrm{i} = 1, \ldots, n)$$

where

n	Number of indirect cost centers
i, j	Indexes of the cost centers
C_j	Primary overhead costs of the indirect cost center j
q_j	Total volume of services of the indirect cost center j
q_{ij}	Volume of services transferred from indirect cost center i to cost center j
c_i	Transfer price of indirect cost center i
c_j	Transfer price of indirect cost center j

Example

https://www.apple.com/de

Situation

After the primary overhead costs have been allocated the company wants perform the interdepartment cost allocation

Task

Determine the transfer prices for the interdepartment cost allocation using the reciprocal method based on equations

Example

Primary overhead costs and quantities of the exchanges of services

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Primary overhead costs [€]	10,000	100,000	120,000	140,000	600,000	200,000	140,000	1,310,000
Services of the indirect cost center								
Energy [kWh]	0	3,000	2,000	20,000	88,000	4,000	3,000	120,000
Property [m²]	500	400	500	1,000	3,000	600	400	6,400
Maintenance [h]	350	650	200	1,000	2,100	250	150	4,700

Reciprocal method based on equations

- System of equations with transfer prices as unknowns:

$$120{,}000\ c_1 = 10{,}000 + 0 \cdot c_1 + 500 \cdot c_2 + 350 \cdot c_3$$
$$6{,}400\ c_2 = 100{,}000 + 3{,}000 \cdot c_1 + 400 \cdot c_2 + 650 \cdot c_3$$
$$4{,}700\ c_3 = 120{,}000 + 2{,}000 \cdot c_1 + 500 \cdot c_2 + 200 \cdot c_3$$

- Solution of the system of equations (by equating or inserting):

c_1 = €0.25 per kWh; c_2 = €19.93 per m²; c_3 = €28.99 per h

Module 3. Cost-center accounting

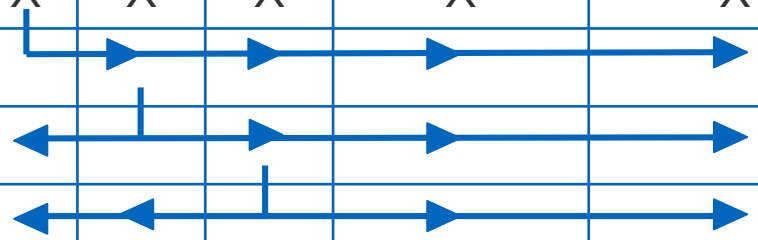
Methods for the allocation of service-department costs

Reciprocal method based on iterations

General characteristics

Concept	Repeated allocation of the costs for internal services in several steps
Accuracy	Approximation; accuracy increases with number of iterations
Recording effort	All internal exchanges of services
Transfer prices	Determination of transfer process for allocation of service exchanges not necessary

	I1	I2	I3	D1	D2
Primary costs	X	X	X	X	X
Secondary cost					
Secondary cost					
Secondary cost					
…….	…	…	…	…	…
Sum	≈0	≈0	≈0	>0	>0



Example

https://www.apple.com/de

Situation

After the primary overhead costs have been allocated the company wants perform the interdepartment cost allocation

Task

Determine the transfer prices for the interdepartment cost allocation using the reciprocal method based on iterations

Example

Primary overhead costs and quantities of the exchanges of services

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Primary overhead costs [€]	10,000	100,000	120,000	140,000	600,000	200,000	140,000	1,310,000
Services of the indirect cost center								
Energy [kWh]	0	3,000	2,000	20,000	88,000	4,000	3,000	120,000
Property [m²]	500	400	500	1,000	3,000	600	400	6,400
Maintenance [h]	350	650	200	1,000	2,100	250	150	4,700

Reciprocal method based on iterations

- First iteration:

  AR_{Energy} = €10,000 / 120,000 kWh = €0.0833 per kWh

  $AR_{Property}$ = €100,250 / 6,000 m² = €16.71 per m²

- Termination of the procedure as soon as the costs on each indirect cost center fall below 2 cents
- Transfer price = Sum of all cost incurred by an indirect cost center at all iteration levels divided by the output to other cost centers

Example

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Primary overhead costs	10,000.00	100,000.00	120,000.00	140,000.00	600,000.00	200,000.00	140,000.00	1,310,000.00
Secondary overhead costs								
1st Iteration	-10,000.00	250.00	166.67	1,666.67	7,333.33	333.33	250.00	0.00
	0.00							
2nd Iteration	8,354.17	-100,250.00	8,354.17	16,708.33	50,125.00	10,025.00	6,683.33	0.00
		0.00						
3rd Iteration	9,996.06	18,564.12	-128,520.83	28,560.19	59,976.39	7,140.05	4,284.03	0.00
			0.00					
4th Iteration	-18,350.23	458.76	305.84	3,058.37	13,456.84	611.67	458.76	0.00
	0.00							
5th Iteration	1,585.24	-19,022.88	1,585.24	3,170.48	9,511.44	1,902.29	1,268.19	0.00
		0.00						
6th Iteration	147.08	273.16	-1,891.08	420.24	882.50	105.06	63.04	0.00
			0.00					
7th Iteration	-1,732.32	43.31	28.87	288.72	1,270.37	57.74	43.31	0.00
	0.00							
8th Iteration	26.37	-316.46	26.37	52.74	158.23	31.65	21.10	0.00
		0.00						
9th Iteration	4.30	7.98	-55.24	12.28	25.78	3.07	1.84	0.00
			0.00					
10th Iteration	-30.67	0.77	0.51	5.11	22.49	1.02	0.77	0.00
	0.00							
11th Iteration	0.73	-8.75	0.73	1.46	4.37	0.87	0.58	0.00
		0.00						
12th Iteration	0.10	0.18	-1.24	0.28	0.58	0.07	0.04	0.00
			0.00					
13th Iteration	-0.83	0.02	0.01	0.14	0.61	0.03	0.02	0.00
	0.00							
14th Iteration	0.02	-0.20	0.02	0.03	0.10	0.02	0.01	0.00
		0.00						
15th Iteration	0.00	0.00	-0.03	0.01	0.01	0.00	0.00	0.00
Total overhead costs	0.02	0.00	0.00	193,945.04	742,768.03	220,211.87	153,075.02	

Module 3. Cost-center accounting

Methods for the allocation of service-department costs

Method of credits and debits

General characteristics

Concept	Assumption that transfer prices for internal services already exist
Accuracy	Approximation, accuracy depending on the transfer prices used
Recording effort	All internal exchanges of services
Transfer prices	Transfer prices are predefined

	I1	I2	I3	D1	D2
Primary costs	X	X	X	X	X
Secondary cost					
Secondary cost					
Secondary cost					
Sum	≠0	≠0	≠0	>0	>0

Transfer price
x Consumption

Predefined

Module 3. Cost-center accounting

Methods for the allocation of service-department costs

Step-ladder method

General characteristics

Concept	Consideration of services between indirect cost centers, but only in one direction
Accuracy	Exact, if only one-sided exchanges of services exist between indirect cost centers, otherwise only approximate
Recording effort	Internal exchanges of services in one direction only
Transfer prices	Transfer prices must be recalculated periodically; the amount of transfer prices varies according to the sequence of the settled indirect cost centers

	I1	I2	I3	D1	D2
Primary costs	X	X	X	X	X
Secondary cost					
Secondary cost					
Secondary cost					
Sum	0	0	0	>0	>0

Example

https://www.apple.com/de

Situation

After the primary overhead costs have been allocated the company wants perform the interdepartment cost allocation

Task

Determine the transfer prices for the interdepartment cost allocation using the step-ladder method

Example

Primary overhead costs and quantities of the exchanges of services

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Primary overhead costs [€]	10,000	100,000	120,000	140,000	600,000	200,000	140,000	1,310,000
Services of the indirect cost center								
Energy [kWh]	0	3,000	2,000	20,000	88,000	4,000	3,000	120,000
Property [m²]	500	400	500	1,000	3,000	600	400	6,400
Maintenance [h]	350	650	200	1,000	2,100	250	150	4,700

Step-ladder method

- Allocation rates:

c_1 = (10,000 + 0) / (120,000 – 0) = €0.0833 per kWh

c_2 = (100,000 + 250) / (6,400 – 500 – 400) = €18.23 per m²

c_3 = (120,000 + 167 + 9,114) / (4,700 – 350 – 650 – 200) = €36.94 per h

Module 3. Cost-center accounting

Methods for the allocation of service-department costs

Direct method

General characteristics

Concept	No consideration of exchanges of services between indirect cost centers
Accuracy	Exact, if no exchanges of services exist between the indirect cost centers, otherwise only approximate
Recording effort	Internal exchanges of services only at direct cost centers
Transfer prices	Transfer prices must be recalculated periodically; relation of primary costs and activity output to direct cost centers

	I1	I2	I3	D1	D2
Primary costs	X	X	X	X	X
Secondary cost					
Secondary cost					
Secondary cost					
Sum	0	0	0	>0	>0

Example

https://www.apple.com/de

Situation

After the primary overhead costs have been allocated the company wants perform the interdepartment cost allocation

Task

Determine the transfer prices for the interdepartment cost allocation using the direct method

Example

Primary overhead costs and quantities of the exchanges of services

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Primary overhead costs [€]	10,000	100,000	120,000	140,000	600,000	200,000	140,000	1,310,000
Services of the indirect cost center								
Energy [kWh]	0	3,000	2,000	20,000	88,000	4,000	3,000	120,000
Property [m²]	500	400	500	1,000	3,000	600	400	6,400
Maintenance [h]	350	650	200	1,000	2,100	250	150	4,700

Direct method

- Allocation rates:

c_1 = 10,000 / (120,000 – 0 – 3,000 – 2,000) = €0.09 per kWh

c_2 = 100,000 / (6,400 – 500 – 400 – 500) = €20.00 per m²

c_3 = 120,000 / (4,700 – 350 – 650 – 200) = €34.29 per h

Module 3. Cost-center accounting

Determining overhead rates for costing

Determining overhead rates

Determining overhead rates for costing

Determining overhead rates for costing	
When?	After the allocation of overhead costs from indirect to direct cost centers
How?	Determination of the allocation bases (e.g. corresponding direct costs)
Why?	Overhead rates are used to calculate the product costs

Example

https://www.apple.com/de

Situation

After a company has allocated overhead costs from indirect to direct cost centers, the company wants to allocate the overhead costs from the direct cost centers to the cost objects

Task

Determine the overhead rates for the allocation of overhead costs from the direct cost centers to the cost objects

Example

Overhead costs after the interdepartment cost allocation

	Indirect cost centers			Direct cost centers				
	Energy	Property	Maintenance	Material	Production	Administration	Sales	Total
Total Overheads [€]	-	-	-	193,945.04	742,768.06	220,211.88	153,075.02	1,310,000.00
Allocation base				direct material costs	direct labor costs	manufacturing costs	manufacturing costs	
amount [€]				560,000.00 €	1,840,000.00 €	3,336,713.10 €	3,336,713.10 €	
Overhead rate				**34.63%**	**40.37%**	**6.60%**	**4.59%**	

Determination of overhead rate for the material overhead costs

Total overhead costs (material cost center) = €193,945.04

- Direct material costs = €560,000 ➤ allocation base
- Overhead rate (material overhead costs) = €193,945.04 / €560,000 = 34.63%

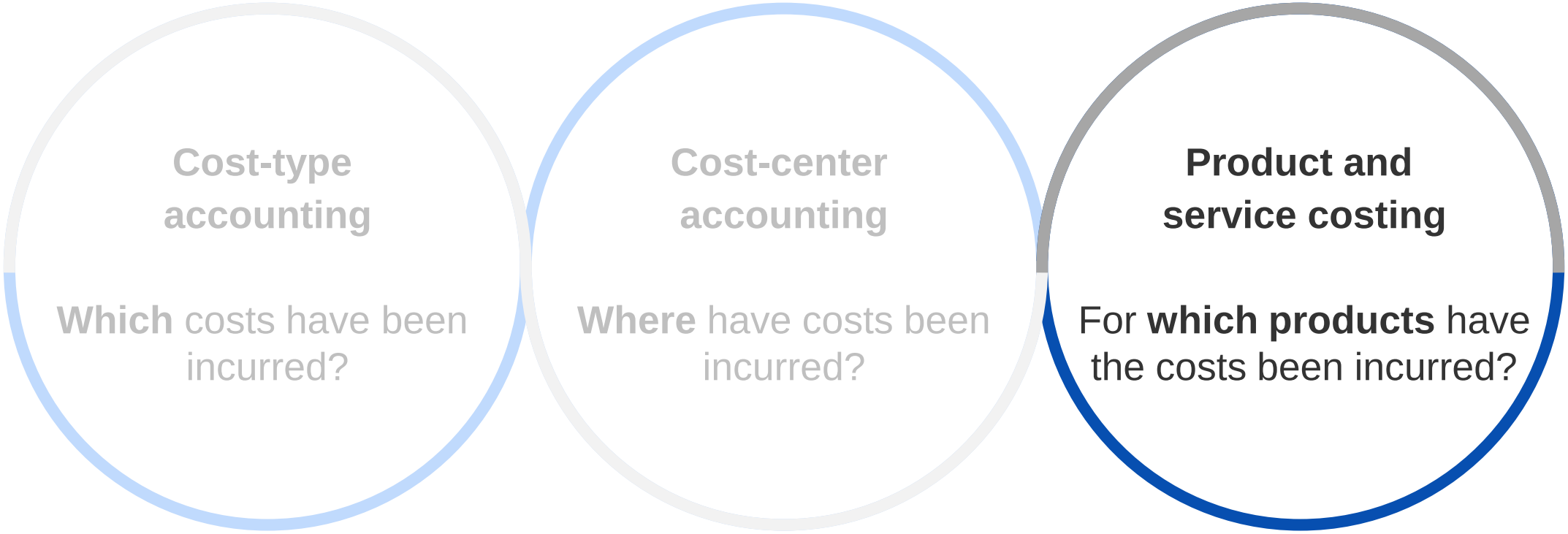
Module 4. Product and service costing

Module 4. Product and service costing

Tasks and design of product and service costing

Tasks of product and service costing

Tasks of product and service costing



Tasks and design of product and service costing

Product and service costing	The costs incurred in the production process are recorded and allocated to the company's products

Purpose		
Planning	**Control**	**Documentation**
• Production program, procurement decisions, and sales or list prices	• Cost control • Performance review	• Inventory valuation

Results	
	Manufacturing costs = material costs + production costs
	Total costs = manufacturing costs + research and development costs + administrative costs + selling and shipping costs

Practical example: sales costing in industrial companies

Picture: ThyssenKrupp

	Total costs
+	Profit mark-up (in % of total costs)
=	Cash sales price
+	Discount (in % of the target sales price)
=	Target sales price
+	Rebate (in % of net list sales price)
=	Net list sales price
+	Sales tax (in % of net list sales price)
=	Gross list sales price

Module 4. Product and service costing

Tasks and design of product and service costing

Classification of cost objects

Classification of cost objects

Classification characteristics	Types of cost objects
Production stage	Final or intermediate products
Purpose	Products to be sold or products to be used by the company itself
Production-related connection	Non-connected products or joint and byproducts
Type of goods	Tangible or intangible goods

Module 4. Product and service costing

Tasks and design of product and service costing

The relationship between program type, product characteristics, and costing method

Relationship between program type and costing method

Program type	Examples	Company examples	Calculation procedure
Individual production	Tanker, large scale plant, tailor-made clothing, feature film	HDW, Linde, Constantin Film	• Job costing • Machine hour costing
Batch production	Business cards, models of a car brand, wine, barware	General Motors, Trigema	
Variant/variety production	Magazines, chemicals, beer, microprocessors	McGraw-Hill Education, BASF, Heineken, AMD	• Process costing • Equivalence number method
Mass production	Electricity, cement, pencil	EnBW, LafargeHolcim, Pelikan	

Relationship between program type, product characteristics, and costing method

	Product characteristic	Calculation procedure
Individual and **batch production**	Job costing	Unit costs = job costs / order volume
Variant/variety and **mass production**	Large quantities and largely homogeneous products	Unit costs = sum of costs per production department / production quantity
Production of **tangible** goods	Change in inventory value	Change in inventory value = manufacturing costs of goods manufactured – manufacturing costs of goods sold
Production of **intangible** goods	No change in inventory value	

Module 4. Product and service costing

Product and service costing for job shop production

The general approach to job costing

The general approach to job costing

	Direct costs	Overhead costs
Characteristics	Can be **directly** traced to an individual job	**Cannot** be directly traced to an individual job → **application** of **cost-allocation bases**, e.g. a single overhead rate
Examples	• Direct material • Direct labor	• Deprecation • Cost of lubricants or operating materials for the use of plants

Example

https://www.cube.eu

Situation

A company that specializes in the production of racing and mountain bikes wants to deal more intensively with product costing

Task

Conduct product costing using a single overhead rate in volume terms

Example

- **Production time** as the cost-allocation base, i.e. overhead rate in **volume terms**

Production hourly rate

$$\frac{Annual\ total\ overhead\ costs}{Annual\ production\ time\ (in\ hours)} = \frac{€1{,}680{,}000}{19{,}200\ hours} = €87.50\ \text{per hour}$$

Direct material	€2,300
Direct production / labor	€1,800
Special direct manufacturing costs (license fee)	€840
Overhead costs (overhead rate €87.50 per hour)	€87.50 per hour * 175 h = €15,312.50
Special direct selling and shipping costs	€135
Total cost of the job (10 units)	**€20,387.50**
Total cost per unit of the job	€20,387.50 / 10 units = €2,038.75

Example

https://www.cube.eu

Situation

A company that specializes in the production of racing and mountain bikes wants to deal more intensively with product costing

Task

Conduct product costing using a single overhead rate in value terms

Example

- **Direct labor** as the cost-allocation base, i.e. overhead rate in **value terms**

Overhead rate (in %)

$$\frac{Annual\ total\ overhead}{Annual\ direct\ costs} \cdot 100 = \frac{€1{,}680{,}000}{€350{,}000} \cdot 100 = 480\%$$

Direct material	€2,300
Direct production/ labor	€1,800
Special direct manufacturing costs (license fee)	€840
Overhead costs (overhead rate 480%)	480% / 100 · €1,800 = €8,640
Special direct selling and shipping costs	€135
Total cost of the job (10 units)	**€13,715**
Total cost per unit of the job	€13,715 / 10 units = €1,371.50

Module 4. Product and service costing

Product and service costing for job shop production

Job costing with multiple overhead rates

Job costing with multiple overhead rates

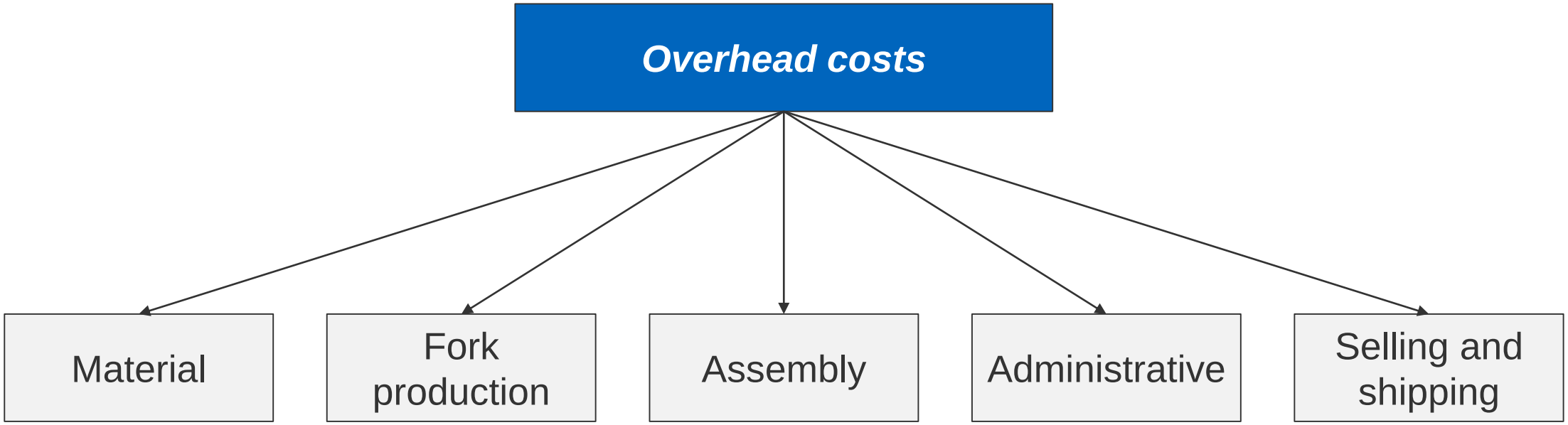
Cost center	Allocation base	Overhead rate or cost rate
Material	• Quantity of material consumed • Direct material	• Cost rate per unit • Overhead rate on material costs
Manufacturing	• Machine hours • Production hours • Quantity of output • Direct labor	• Cost rate per hour • Cost rate per unit • Overhead rate on production wages
Administration	• Hours of administrative work • Quantity of administrative services • Direct labor • Manufacturing costs	• Cost rate per hour • Cost rate per unit • Overhead rate on direct labor • Overhead rate on manufacturing costs
Selling and shipping	• Direct labor • Manufacturing costs	• Overhead rate on direct labor • Overhead rate on manufacturing costs

Practical example: Job costing in industrial companies

<table>
<tr><td>Direct material costs</td><td rowspan="2">Material costs</td><td rowspan="6">Manufacturing costs</td><td rowspan="9">Total costs</td></tr>
<tr><td>Material overhead</td></tr>
<tr><td>Direct labor costs</td><td rowspan="3">Production costs</td></tr>
<tr><td>Production overhead</td></tr>
<tr><td>Special direct production/ manufacturing costs</td></tr>
<tr><td colspan="3">Administrative overhead</td></tr>
<tr><td colspan="3">Selling and shipping overhead</td></tr>
<tr><td colspan="3">Special direct selling and shipping costs/overhead</td></tr>
</table>

Product costing using multiple overhead rates

- Break down of overhead costs by **cost centers**



Example

https://www.cube.eu

Situation

After conducting simple product costing, the company wants to break down overhead costs by cost centers to gain more detailed information

Task

Conduct product costing using multiple overhead rates

Example

- Break down of overhead costs by **cost centers**

Overhead of the cost center		Cost allocation base		Overhead rate
Material overhead	€50,000	Direct material	€320,000	15.63%
Manufacturing overhead (fork production)	€425,000	Product weights	12,500 kg	€34.00 per kg
Manufacturing overhead (assembly)	€890,000	Production hours	12,500 h	€71.20 per h
Administrative overhead	€102,350	Manufacturing costs	€2,047,000	5.0%
Selling and shipping overhead	€212,650	Manufacturing costs	€2,047,000	10.39%
Total	€1,680,000			

- **Additional information:**
  - Special direct manufacturing costs: €12,000
  - Total production hours: 19,200 h (6,700 h for fork production,12,500 h for assembly)
  - Total weight of ten bikes: 125 kg
  - Total assembly time: 54 h

Example

Direct material	€2,300	
Material overhead (15.63% of €2,300)	0.1563 · €2,300 = €359.49	
Material costs		€2,659.49
Direct labor	€1,800	
Manufacturing overhead		
- Fork production (€34 per kg)	€34 per kg · 125 kg = €4,250	
- Assembly (€71.20 per h)	€71.20 per h · 54 h = €3,844.80	
Special direct manufacturing costs	€840	
Production costs		€10,734.80
Manufacturing costs		**€13,394.29**
Administrative overhead (5%)		0.05 · €13,394.29 = €669.71
Selling and shipping overhead (10.39%)		0.1039 · €13,394.29 = €1,391.67
Special direct selling and shipping costs		€135
Total cost of the job		**€15,590.67**

Module 4. Product and service costing

Product and service costing for job shop production

Machine-hour costing

Machine-hour costing

Background

- Increasing automation of production processes
- Installation of flexible manufacturing systems
- Computer-integrated production
- **Takeaway**: total labor costs and production times are less suitable cost-allocation bases

Alternative allocation bases

- Machine times
- Lead times
- Processing times

Machine-hour costing

- **Break-down** of **machine-related overhead** by machines and allocation according to machine usage
- Machine-hour costing = **specific form** of job costing

Example

https://www.cube.eu

Situation

After conducting product costing with multiple overhead rates, the company wants to further increase the accuracy of the job costing system

Task

Conduct product costing using machine-hour rates

Example

- Information about the welding machines of the fork production department

	Welding machine *FANUC*	Welding machine *KUKA*
Purchase price	€290,000	€467,500
Economic useful life	8 years	10 years
Space required	15 m²	23.2 m²
Apparent power	16.45 kVA (1W = 1VA)	19.8 kVA (1W = 1VA)
Operating costs	€7.45 per hour	€9.25 per hour
Machine time	6,520 hours/year	5,875 hours/year

- Additional information:
  - Depreciation — Straight-line based on the economic useful life
  - Imputed interest — average capital tied up over the useful live (12% p.a.)
  - Maintenance costs — p.a. 2% of purchase price
  - Room utilization costs — p.m. €22 per m^2
  - Active electrical power — 70% of the load limit specified as apparent power
  - Electricity costs — €0.18 per kWh

Example

	Welding machine *FANUC*	Welding machine *KUKA*
Depreciation	€290,000 / 8 = €36,250	€467,500 / 10 = €46,750
Imputed interest	0.5 · €290,000 · 0.12 = €17,400	0.5 · €467,500 · 0.12 = €28,050
Maintenance costs	0.02 · €290,000 = €5,800	0.02 · €467,500 = €9,350
Room utilization costs	15 · €22 · 12 = €3,960	23.2 · €22 · 12 = €6,124.80
Electricity costs	16.45 · 0.7 · 0.18 · €6,520 = €13,514	19.8 · 0.7 · 0.18 · €5,875 = €14,656.95
Operating costs	7.45 · €6,520 = €48,574	9.25 · €5,875 = €54,343.75
Machine-related overhead	**€125,498**	**€159,275.50**
Machine-hour rates	€125,498 / 6,520 h = **€19.25 per h**	€159,275.50 / 5,875 h = **€27.11 per h**

- Information about the fork production machines
  - Total overhead — €425,000
  - Overhead not dependent on machine times — €140,226.50 (= €425,000 - €125,498 - €159,275.50)
    - Allocation based on product weight
    - Overhead rate — €11.22 per kg (= €140,226.50 / 12,500 kg)
  - Job usage — 78 h, exclusively on *KUKA* system

Example

Direct material	€2,300	
Material overhead (15.63% of €2,300)	0.1563 · €2,300 = €359.49	
Material costs		€2,659.49
Direct labor	€1,800	
Manufacturing overhead		
- Fork production (€11.22 per kg, €27.11 per h KUKA)	€11.22 per kg · 125 kg = €1,402.50 €27.11 per h · 78 h = €2,114.58	
- Assembly (€71.20 per h)	€71.20 per h · 54 h = €3,844.80	
Special direct manufacturing costs	€840	
Production costs		€10,041.88
Manufacturing costs		**€12,701.37**
Administrative overhead (5%)		0.05 · €12,701.37 = €635.07
Selling and shipping overhead (10.39%)		0.1039 · €12,701.37 = €1,319.67
Special direct selling and shipping costs		€135
Total cost of the job		**€14,791.11**

Overview of approaches to calculate the costs for the job

Approach	Total cost per unit
Production time as cost-allocation base in volume terms	€2,038.75
Direct labor as cost-allocation base in value terms	€1,371.50
Individual cost-allocation bases for each cost center	€1,559.07
Machine-hour costing	€1,479.11

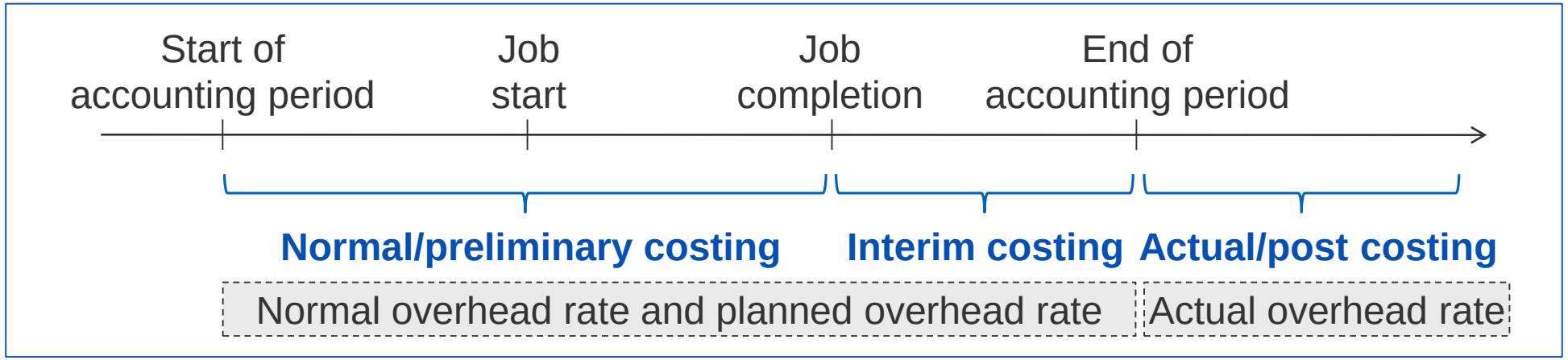
Module 4. Product and service costing

Product and service costing for job shop production

Actual costing, interim costing, and normal costing

Times and forms of job costing

Times



Forms

Normal/preliminary costing	• Until job completion • Production program, negotiation or price policy planning
Interim costing	• Promptly after job completion • Cost and profit control
Actual/post costing	• After the end of the accounting period • Inventory valuation, costs, and profit control

Time-dependent overhead rates

Actual overhead rate	$= \frac{Actual\ overhead\ costs}{Actual\ production\ time\ (in\ hours)}$
Normal overhead rate	$= \frac{Average\ overhead\ costs}{Average\ production\ time\ (in\ hours)}$
Planned overhead rate	$= \frac{Planned\ overhead\ costs}{Planned\ production\ time\ (in\ hours)}$

Times and forms of job costing

- Whether a company uses actual costing, interim costing, or normal costing does **not affect the general structure of job costing**
- **Example**: predetermined overhead rate

Normal/preliminary costing	Interim costing	Actual/post costing
Planned direct costs + Planned overhead *(Planned overhead rate · planned production time)*	Actual direct costs + Normal overhead *(Normal overhead rate · actual production time)*	Actual direct costs + Actual overhead *(Actual overhead rate · actual production time)*
= Total planned costs	= Total normal costs	= Total actual costs

Example

https://www.cube.eu

Situation

The company producing racing and mountain bikes now wants to determine the total cost of another job timely

Task

Conduct product costing using normal overhead rates

Example

Determination of normal overhead rate from past values

Year	-4	-3	-2	-1	Average
Overhead costs	€1,870,000	€2,105,000	€1,940,000	€1,680,000	€1,898,750.00
Production time in h	20,750	21,210	18,750	19,200	19,977.50

Normal overhead rate €1,898,750 / 19,977.50 h = **€95.04 per h**

Information for the job

Production material	€5,720
Production time	274 h
Direct labor	€2,960
Special direct selling and shipping costs	€576

Costing

Production material	€5,720
Direct labor	€2,960
Overhead costs (€95.04 per h · 274 h)	€26,040.96
Special direct selling and shipping costs	€576
Total cost of the job	**€35,296.96**

Module 4. Product and service costing

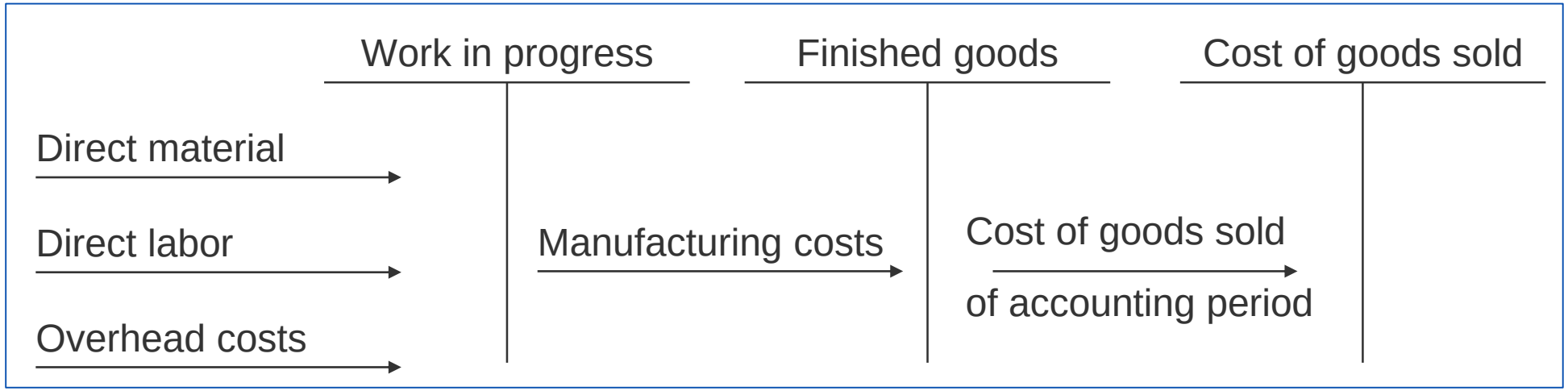
Product and service costing for job shop production

Book keeping for job shop production

Bookkeeping for job shop production

- Successive recording of material consumption, direct labor, and overhead costs
- Examples: Work in progress to raw material
  Work in progress to wages and salaries

Schematic flow of manufacturing costs



Module 4. Product and service costing

Product and service costing for mass and variant production

Single-stage process costing

Single-stage process costing

- Examples for single-product production: electricity, forestry, and water industry

Total cost per unit	= total costs of the period / quantity produced

- Example: Process costing in a forestry operation

Wages and salaries	€180,000
Operating materials / tools	€5,000
Depreciation and amortisation of plant and vehicles	€15,000
Other administrative, selling, and shipping overhead	€25,000
Total cost	€225,000
Timber cutting volume	18,750 scm

→ $Unit\ cost\ per\ timber = \frac{Total\ cost}{Output\ quantity} = \frac{€225{,}000}{18{,}750\ scm} = €12\ per\ scm$

Module 4. Product and service costing

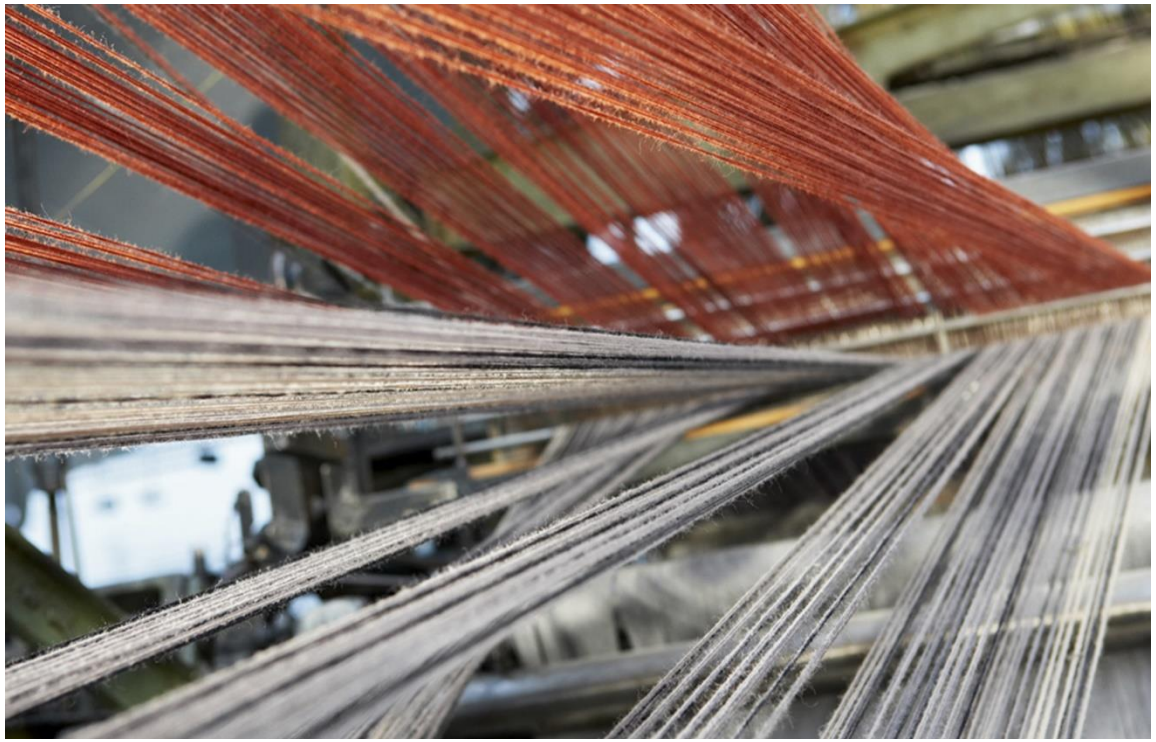
Product and service costing for mass and variant production

Multi-stage process costing

Multi-stage process costing

Multi-stage process costing	Application if the manufacturing process meets different quality standards, stock changes occur to varying degrees or the products’ degrees of completion differ
Starting point	Physical flow of products and quantities between different production stages

Example



https://www.carpet-concept.de/

Situation

A company produces carpets in four manufacturing stages and with different quality standards

Task

Conduct multi-stage process costing while not distinguishing between finished and un-finished intermediate products within the production flow

Example

- Example: Process costing in a carpet production (in 1,000 m^2)

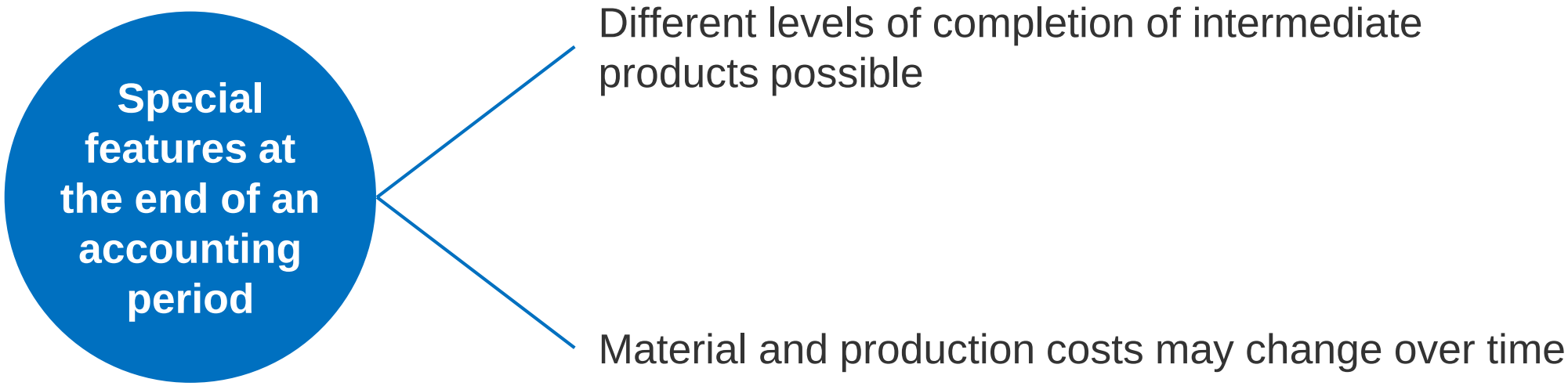
Area	Production I	Production II	Production III	Packaging & Distribution
Input quantity		250	210	201
Rejects	0	5	12	0
Output quantity	270	245	198	201
Quantity to be reused	250	210	201	–
Change in stock	+ 20	+ 35	– 3	–

Example

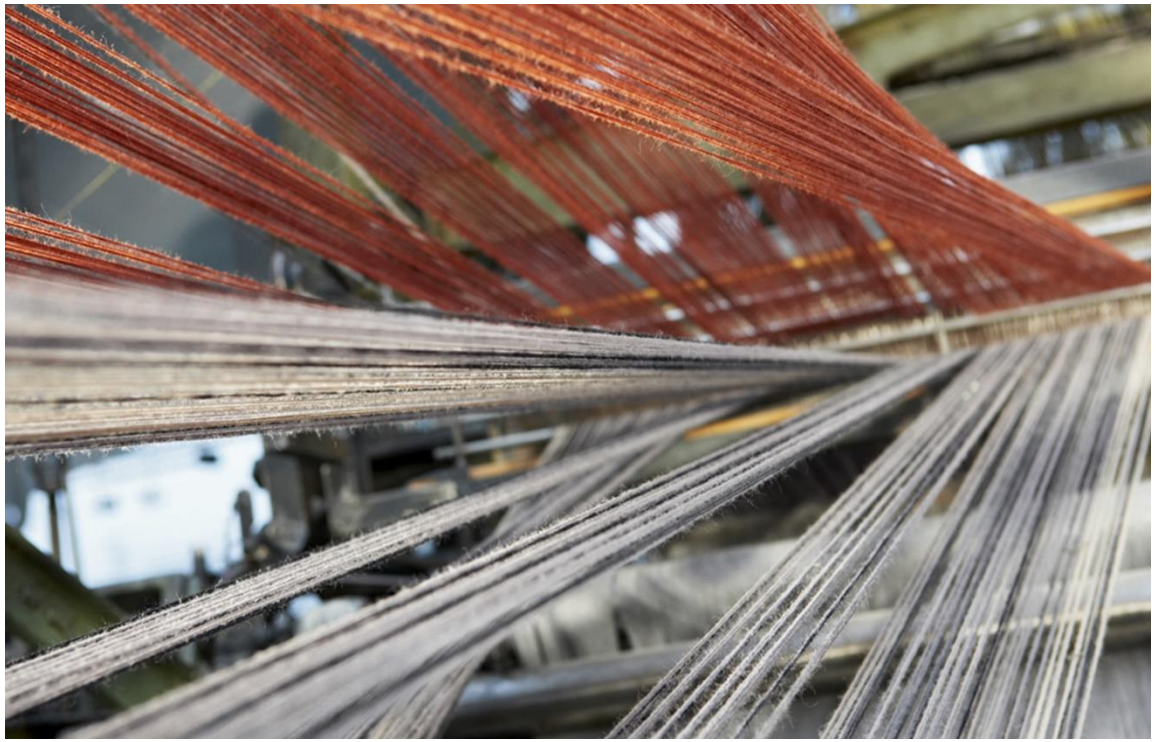
- Recording of costs at department level
- Differentiation between **primary step costs** and costs of preliminary products
- For each stage of a multi-stage process costing, companies apply the same procedure as in a single-stage process costing

Step	Area	Input quantity [1,000 m²]	Output quantity [1,000 m²]	Primary step cost	Costs of preliminary products	Total costs per stage	Stage-related unit costs per 1,000 m²
1	Production I	0	270	€675,000	-	€675,000	€2,500
2	Production II	250	245	€1,942,600	€625,000	€2,567,600	€10,480
3	Production III	210	198	€846,420	€2,200,800	€3,047,220	€15,390
4	Packaging & distribution	201	201	€136,680	€3,093,390	€3,230,070	€16,070

Special features at the end of an accounting period



Example



https://www.carpet-concept.de/

Situation

Now, the carpet producer wants to take differences in the unfinished products' degree of completion into account

Task

Analyze production progress in production step 1

Example

- Example: Analysis of production progress in production step 1

	Quantity [1.000 m^2]	Degree of completion	Equivalent units	
			Material costs	Production costs
Finished intermediate product	260	100%	260	260
Unfinished intermediate product	10	70%	10	7
Total equivalent units			270	267

Example

- Assignment of costs to finished and unfinished units at production level I

	Material costs	Production costs	Total costs
Costs of the accounting period	€224,100	€450,900	€675,000
Equivalent units	270	267	-
Cost per equivalent unit	€830 = €224,100 / 270	€1,688.76 = €450,900 / 267	**€2,518.76** = €830,00 + €1,688.76

- Considering unfinished intermediate products affects stage-related unit costs of all subsequent production stages
- Calculation of costs in the next accounting period:
  - Cost for unfinished intermediate product = €830 · 10 + €1,688.76 · 7 = €20,121.32

Module 4. Product and service costing

Product and service costing for mass and variant production

Equivalence number method

Equivalence number method

Determination of costs of …	• … related products which are … • … produced on similar manufacturing equipment and … • … using similar raw materials
Examples	• Breweries that brew several types of beer • Foundries that cast similar types of molds • Companies that produce several types of screws
Basic assumption	• Fixed relationship between the costs of the related products • $\frac{Manufacturing\ costs\ per\ unit\ of\ series\ x}{Manufacturing\ costs\ per\ unit\ of\ the\ basic\ type} = \frac{Equivalence\ number\ of\ series\ x}{Equivalence\ number\ of\ the\ basic\ type}$

Example

https://www.vdi-wissensforum.de

Situation

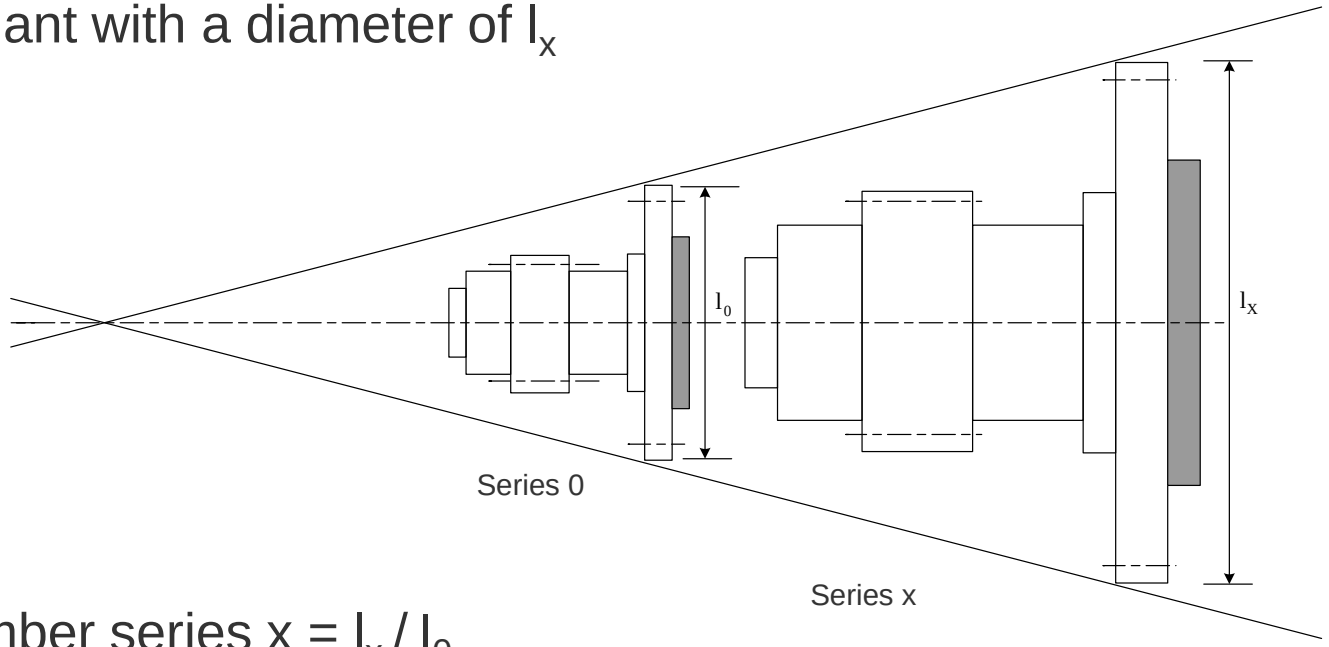
A foundry casts different sizes of gear wheels which have a fixed relationship to each other

Task

Use the equivalence number method to determine the cost of the related products

Example

- Production of gears of different sizes
  - Series 0 = basic type with a diameter of l_0
  - Series x = variant with a diameter of l_x



- Equivalence number series x = l_x / l_0

Example

Series	Gear diameter [cm]	Equivalence number	Production quantity [units]	Equivalent quantity	Manufacturing costs per unit	Total cost of series
B0	25.00	1.00	4,500	4,500	€61.52	€276,843.57
B1	18.75	0.75	2,100	1,575	€46.14	€96,895.25
B2	32.50	1.30	2,570	3,341	€79.98	€205,540.97
B3	37.50	1.50	1,850	2,775	€92.28	€170,720.20
Sum				12,191		€750,000.00

Module 4. Product and service costing

Product and service costing for mass and variant production

Cost allocation for joint products and byproducts

Cost allocation for joint products and byproducts

- **Production of joint products and byproducts** occurs when several products are produced simultaneously in a production process
- Practical examples:

Exploration and development of oil and gas reserves	• Crude oil and natural gas of varying quality • Other raw materials, e.g. carbon dioxide
Processing of raw milk	• Cream and skimmed milk
Dismantling of old cars	• Valuable materials: metals, tyres, spare parts • Materials that cannot be reused: waste oil, …
Donation of blood	• Erythrocytes (red blood cells), leukocytes (white blood cells), thrombocytes (blood platelets), and blood plasma

Procedures to calculate costs of joint products and byproducts

Main-product method	• Breakdown into main products and byproducts • The profits of by-products are deducted from the total costs incurred before the **decoupling point**
Distribution method based on **production volumes**	• Allocation of costs incurred before the decoupling point according to produced quantities or weight • Determination of profit for all products
Distribution method based on **market values**	• Allocation of costs incurred before the decoupling point according to market values