

## **Course: Management Accounting**

**Field of study:** Finance and Accounting

**Type of instruction and number of hours:** lecture 30 h, project 30 h

**Number of ECTS credits:** 5

### **Learning outcomes:**

- Student understands the criteria and principles of classification of costs in the enterprise.
- Student knows the cost accounting systems.
- Student knows the issue of Break-Even Point, operational and financial leverage.
- Student understands the concept and usefulness of working capital management.
- Student knows the principles of budgeting.
- Student understands the impact of information (obtained by methods of management accounting) on decisions taken by the management.
- Student is able to classify costs in an enterprise. He is able to carry out costs and price calculation.
- Student is able to calculate Break-Even Point, degree of financial and operational leverage.
- Student is aware of the responsibility of financial accounting department employees for successes and failures of a company and even loss of jobs by other employees and the company's bankruptcy.

### **Evaluation methods of learning outcomes:**

written test, exam, oral exam, discussion

### **List of course topics:**

1. Introduction – management accounting and financial accounting, management accounting tasks, management accounting and costs calculation.
2. Cost as an element of the decision-making process. Classification of costs for management purposes.
3. Variable and full costing approach.
4. Methods of costing.
5. Break-Even Point analysis.
6. Operating and financial leverage.
7. Pricing decisions.
8. Short-term operational decisions.
9. Strategies of working capital management.
10. Current assets and liabilities management.
11. Budgeting as a method of company management.

## References

- [1] Bruns W. J., *Accounting for Managers*, South Western Publishing Co., Cincinnati, Ohio USA, 1994.
- [2] Cooper W. W., Yuji I., *Kohler's Dictionary for Accountants*, 6<sup>th</sup> ed. Englewood Cliffs, NJ : Prentice-hall, 1983.
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## 1. Introduction – management accounting and financial accounting, management accounting tasks

The development of management accounting is associated with the industrial revolution of the 18<sup>th</sup> and 19<sup>th</sup> centuries. Products began to be manufactured on an industrial scale. The complexity of production processes has increased. Larger enterprises with an extensive organizational structure began to be set up, which resulted in inability to control performance only through observation and supervision. There was a need to introduce new management methods and a scientific approach to the organization of work.

Management accounting has developed on the basis of costs, with particular emphasis on the calculation of unit costs. The wide inclusion of accounting in the enterprise management process has become the basis for distinguishing two types of accounting, i.e.:

- financial accounting,
- management accounting.

Table 1.1. Distinctions between Management Accounting and Financial Accounting [5]

	Management Accounting	Financial Accounting
Primary users	Organization managers at various levels.	Outside parties such as investors and government agencies but also organization managers.
Freedom of choice of accounting measures	No constraints other than requiring the benefits of improved management decisions to exceed information costs.	Constrained by generally accepted accounting principles (GAAP).
Behavioral implications in selecting accounting measures	Choice should consider how measurements and reports will influence managers' daily behavior.	Choice based on how to measure and communicate economic phenomena. Behavioral considerations are secondary, although executive compensation based on reported results may have behavioral impacts.
Time focus of reports	Future orientation: formal use of budgets as well as historical records. Example: 20X2 budget versus 20X2 actual performance.	Past orientation: historical evaluation. Example: 20X2 actual performance versus 20X1 actual performance.
Time span of reports	Flexible, varying from hourly to 10 to 15 years.	Less flexible; usually one year or one quarter.
Types of reports	Detailed reports: includes details about products, departments, territories, etc.	Summary reports: primarily report on the entity as a whole.
Influence of other functional areas	Field is less sharply defined. Heavier use of economics, decision sciences, and behavioral sciences.	Field is more sharply defined. Lighter use of related disciplines.

## *Management Accounting*

Management accounting:

- is a part of modern accounting that is directly related to the processes of managing an enterprise,
- is the most important source of economic information for description of various decision-control situations that arise in specific conditions of enterprise management.

**Management accounting** can be defined as a process of providing financial information and resources to managers in decision making.

The most general function of management accounting is the **information function**, which consists in creating information on economic phenomena and processes taking place in an enterprise and adapting them to the information needs of information users in order to form opinions and make decisions.

Taking into account the division of decisions made in enterprises into strategic and operational ones, two departments of management accounting can be distinguished: **strategic management accounting and operational management accounting**.

**Strategic management accounting** can be defined as a management accounting section whose task is to create an information system supporting strategic decisions. It should provide a basis for making long-term economic decisions. Strategic management accounting is embedded in the process of strategic management of a company, carried out by its top management team. This accounting should focus on providing relevant information on possible options for the operation and development of the enterprise in the future, as well as information on the environment in which the enterprise operates.

**Operational management** accounting can be defined as a section of management accounting whose primary task is to provide information for making operational decisions, and therefore for making short-term economic decisions. Operational management accounting is included in the process of operational management of an enterprise, usually carried out by lower management levels. This accounting should focus on the systematic, timely provision of information on the current activity of the enterprise as well as the degree of implementation of tasks and the use of resources.

## **2. Definition of costs and costs classification**

One of the **purposes of the accounting information system** is to record and maintain historical records. These records provide information on the operations of an organization. More and more of the efforts of management accountants are being devoted to future-oriented data and decisions rather than historical record keeping. The development of budgets, standard costs, special studies, make-or-buy decisions and forecasting all relate to future. Past performance may help improve future performance, but care must be taken not to use historical data, as is, to present future data.

**Management accounting** is the presentation of accounting information in such a way as to assist management in the creation of policy and in the day-to-day operation of an undertaking. Management accounting may be defined as an application of accounting techniques to provide information designed to assist all levels of management in the following areas:

- planning,
- decision making,
- controlling the activities of the organization.

**Planning** requires an assurance that historical and prospective information develop a schedule for future activities, showing what resources are required and what expected results will be achieved. Planning can be done at the strategic, tactical or operating levels. Budgeting is a numerical expression of a plan of action used to coordinate and implement activities.

**Decision making** is preceded by the process of evaluating which means assessing the implications of both historical and expected events in order to select an appropriate course of action. In the evaluation process it is often necessary to translate data into trends and relationships. Evaluation is required before decisions can be made.

If company is to achieve the goals embodied in its plans, the management must exercise **control** over the company's activities. Control is the process of directing a set of variables toward a determined objective. According to the Management Accounting Practices Committee of the IMA: *control function refers to activities which are designed to compel events to conform to plans. It implies (a) that there is some standard or set of standards, (b) that performance is compared against the standards(s) on a continuous or frequent basis, and (c) that corrective action is taken when there is a deviation from the outside limits of that standard* [6, p. 6-7].

## 2.1. Definition of cost

The term 'cost' has no unique meaning and can express different connotations depending upon how the term is used or expressed. In financial accounting, the term **cost** is defined as the sacrifice made in order to obtain some good or service. The sacrifice may be measured in for example in cash expended, service rendered. In managerial accounting, the term 'cost' is used in many different ways because there are many different types of costs.

According to *Kohler's Dictionary for Accountants* **cost** can be defined as:

*An expenditure or outlay of cash, other property, capital stock, or services, or the incurring of a liability therefore, identified with goods or services acquired with any loss incurred, and measured by the amount of cash paid or payable or the market value of other property, capital stock, or services given in exchange or, in other situations, any commonly accepted basis of valuation. Implicit in the concept of cost is the accrual basis of accounting* [2, p. 131-132].

## 2.2. Cost classification

Costs can be measured and classified by various methods. The classification of costs is the basis of all cost accounting systems. Classification of costs is the identification of each item of cost and the systematic placement of like items of cost together according to their common characteristics.

Costs can be classified by:

- nature of expense,
- time period,
- function,
- volume of activity.

When costs are classified **by the nature of expense** it means that a cost is classified by the intrinsic characteristics of the expenditure for example depreciation, advertising, insurance, rent.

Costs can be classified **by time period** to relate expired costs to different accounting periods. The reason of this classification is that most accounting reports are for a defined period of time. **Capital expenditure** is a cost which is intended to benefit a future accounting period and is classified as an asset. **Revenue expenditure** is a cost which benefits the current accounting period only and is classified as an expense. When capital expenditures are consumed in the process of generating revenue they flow into the expense stream.

Classification of costs **by function** involves the classification of costs by operations or activities of an entity. Costs can be divided into two main groups:

- manufacturing,
- non-manufacturing.

**Manufacturing** involves the conversion of raw materials into finished products through the efforts of factory workers and the use of production equipment. The **cost of a manufactured product** is made up of the following elements:

- direct materials,
- direct labor,
- manufacturing overhead.

**Direct materials** are the various substances or raw materials that are traceable and required to produce a physical product or output, i.e. wood in a table.

**Direct labor** is the effort used by the employees working specifically to convert the direct materials into a finished product. Direct materials and direct labor are collectively named as **prime costs**.

**Manufacturing overhead** can be defined as including all costs of manufacturing except direct materials and direct labor. Only those costs that are associated with operating the factory would be included in the manufacturing overhead category. For example: indirect materials, indirect labor, heat, light, property taxes, insurance, repairs, maintenance, depreciation on factory facilities.

**Indirect materials** are items of materials that are traceable into the product only at great cost and inconvenience. For instance the glue used to put a table together. **Indirect labor** means labor costs that cannot be physically traced to the creation of products, or that can be traced only at great cost and inconvenience. For instance the labor costs of night security guards, materials handlers, engineers. Because the indirect cost cannot be directly associated with the production of a cost unit or with the activity of a cost center it has to be apportioned to the cost center or absorbed by the cost unit on a suitable basis. Direct labor and manufacturing overhead put together are known as **conversion cost** which is the cost to convert a raw materials into a finished product.

**Nonmanufacturing** costs are the portion of the operating expenses that are not related to the manufacturing operation and have been referred to as commercial expenses in one accounting textbook [7].

Nonmanufacturing costs can be divided into two groups:

- marketing expenses,
- administrative expenses.

Marketing expenses are the expenses incurred to sell or distribute a product or service. They include such items as sales commissions, advertising, freight out, travel and entertainment. Administrative expenses include the expenses incurred to direct and control an organization. We can include here, for example, telephone expenses, audit expenses, human resource department costs.

Classification of costs **by function** can also be presented in the following way:

- production,
- marketing and sales,
- administration,
- research and development.

Within functions costs are allocated by **cost centers** and within cost centers by **cost units**. A **cost center** is a location such as a department or part of a department, a person or groups of persons, or an item or group of items of equipment, for which costs are ascertained for the purposes of control.

A **cost unit** is a unit of product, service or time in relation to which costs may be ascertained or expressed. Cost unit is used to measure the efficiency of cost centers. Examples of cost unit include: job, batch, contract, product group.

How the cost changes as the **activity volume** changes is very important for cost planning and control purposes. Costs are generally classified as being variable, fixed, mixed (semivariable/semifixed), or step.

**Variable cost** is a cost that changes in direct proportion to changes in activity volume. A variable cost has a constant cost per activity unit so that the total cost varies directly as volume changes within a relevant range. An example of a variable cost is direct material.

**Fixed cost** is a cost that remains constant in total during a time period as activity volume changes within a relevant range of activity. Fixed costs can be divided into:

- **committed costs** which are the result of some previous managerial decision and arise from having property, plant, equipment and functioning organization. They are difficult to influence in the short run.
- **discretionary (managed, programmed) costs** which arise from periodic appropriation decisions. These decisions reflect the management's professional judgment regarding the amount to be incurred. In opposition to committed costs, these costs, for example marketing and administrative costs, can be altered in the short run.

**Mixed (semivariable/semifixed) costs** have both fixed and variable elements. These costs include an amount that is fixed within a relevant range of activity and an amount that varies proportionately as activity changes. An example is maintenance cost.

**Step cost** increases or decreases only in response to a great change in activity level and then changes by a significant amount.

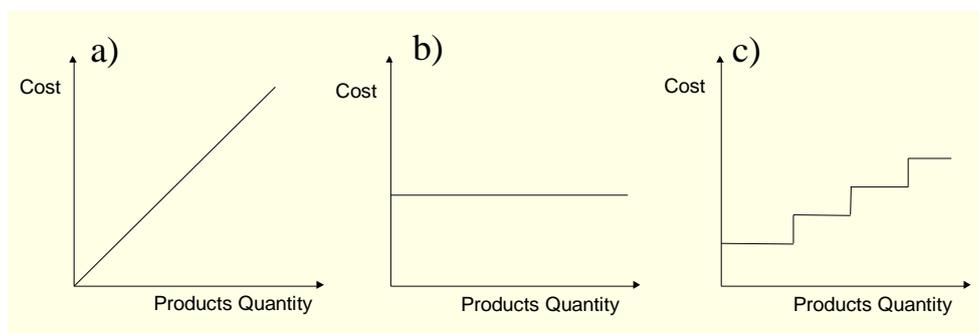


Figure 2.1. Different kinds of costs: a) variable proportional costs, b) fixed costs, c) step-variable costs [1, 4, 8, 9]

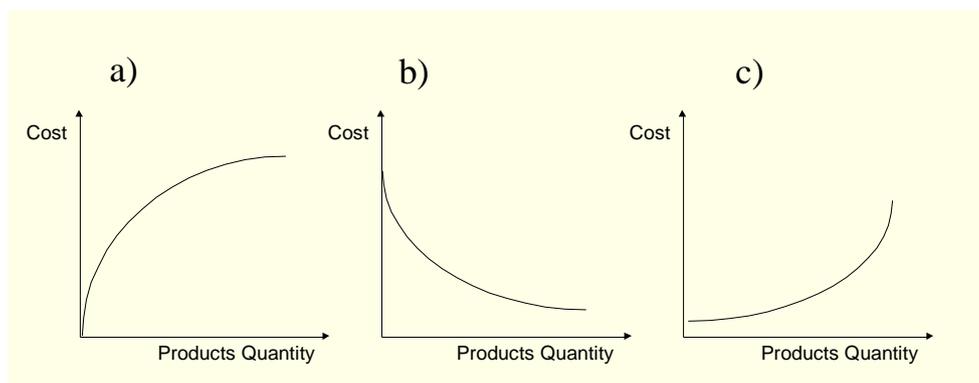


Figure 2.2. Different kinds of variable costs: a) degressive, b) regressive costs, c) progressive costs [1, 4, 8, 9]

Total cost function  $TC(q)$  which depends on production volume can be presented as

$$TC(q) = TC(F, V(q)),$$

where:

$F$  – fixed costs,

$V$  – variable costs,

$q$  – quantity of products.

Important issue is behavior of costs in case of little changes in production volume. Increase in total cost caused by little production increase is called **marginal cost**. Mathematically marginal cost is equal to the first derivative of function of total cost.

If total cost  $TC(q)$  is a linear function:

$$TC(q) = F + q \cdot v,$$

where:

$F$  – fixed costs,

$v$  – variable unit costs,

then marginal cost is equal to a variable unit cost

$$\frac{\partial TC}{\partial q} = v.$$

Among other very detailed classifications used by managers there is also a definition of **opportunity cost** which is the potential benefit that is lost or sacrificed when the selection of one course of action makes it necessary to give up on a competing course of action. Virtually every alternative has some opportunity cost attached to it. Opportunity cost is not usually entered in the books of an organization, but it is a cost that must be explicitly considered in every decision a manager makes.

Thanks to the exhibit above we can see how products costs move through the various accounts and affect the balance sheet and the income statement in the course of the manufacture and sale of goods. Direct materials cost, direct labor cost and manufacturing overhead cost are all added into Work in Process. As goods are completed their cost is transferred from Work in Process into Finished Goods. Here the goods await sale to a customer. As goods are sold, their cost is then transferred from Finished Goods into Cost of Goods Sold. It is at this point that the various material, labor and overhead costs that have been involved in the manufacture of the units being sold are treated as expenses in determining the net income or loss for the period. Costs of products associated with the units in the Work in Process and Finished Goods inventory accounts at the end of the period will appear on the balance sheet at that time as part of the company's assets. Selling and administrative expenses are not involved in the manufacture of a product. This is why they are treated as period costs (not product costs). They go directly into expense accounts as they are incurred.

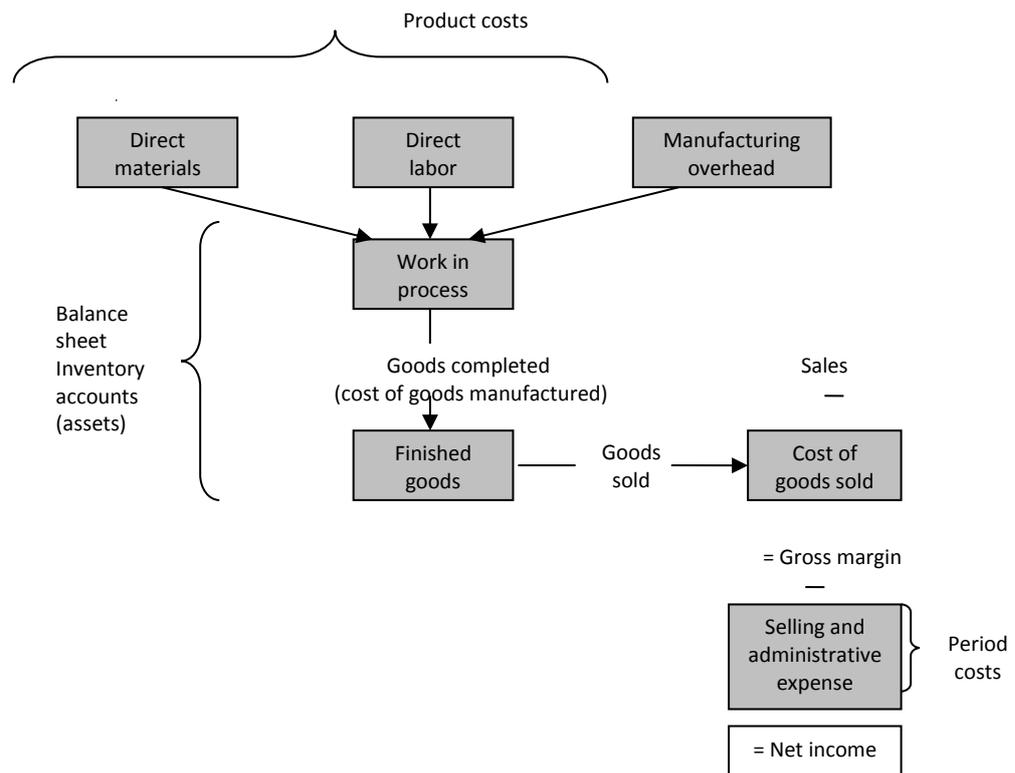


Figure 2.3. Cost flows and classifications [4]

### 3. Variable and full costing approach

Variable costing is useful for planning and control, but absorption costing is required for external reporting.

Variable (direct, marginal) costing method (VarC) include only the variable manufacturing costs:

- direct materials,
- direct labor,
- and only variable manufacturing overhead

in the unit cost of a product. The full amount of fixed costs are expenses in the year incurred.

Full (absorption) costing method (FullC) include:

- direct materials,
- direct labor,
- both variable and fixed manufacturing overhead

in the unit cost of a product.

#### The systems differ in their approach to inventory valuation.

In full costing (FullC) approach, products are valued at the level of their full manufacturing cost. Fixed manufacturing overhead costs are also accounted for in product inventories. In variable costing (VarC) approach products are valued only at variable manufacturing cost. Fixed manufacturing overhead costs are treated as costs of the reporting period and are fully charged to Financial Result (FR). The approach to non-productive costs (selling and administrative expenses) is identical in both models: these costs are treated as costs of a given reporting period.

Due to the different approach to the valuation of inventories, the reported FR is also different in both systems.

If production > sales then → FR in to FullC approach > FR in VarC approach

If production < sales then → FR in to FullC approach < FR in VarC approach

If production = sales then → FR in to FullC approach = FR in VarC approach

1. In short periods, the amount of FR shown in FullC approach and VarC approach will be different. In the long run, the FR established in both systems of the account will be identical.
2. In FullC approach, profit is a function of sales volume and production volume. Therefore, under certain conditions, with an increase in sales, the profit calculated on the basis of FullC will decrease with a constant sales price and a constant cost structure. This is not possible when VarC approach is used. With this calculation, an increase in sales volume with a constant product price and a constant cost structure always increases profit.

**Example 3.1. [3]**

Assumptions:

- product price 50 EUR,
- variable unit cost 30 EUR,
- fixed overhead costs 60 000 EUR,
- administrative expense 6 000 EUR,
- selling expense 4 000 EUR.

Table 3.1. Data on production, sale and inventory level

Specification	1 <sup>st</sup> period [in units]	2 <sup>nd</sup> period [in units]	3 <sup>rd</sup> period [in units]
Beginning inventory	-	1 000	200
Production	5 000	4 000	5 300
Sale	4 000	4 800	5 500
Ending inventory	1 000	200	-

Calculate financial results and the value of inventory in these three periods using FullC and VarC approach. Compare and interpret the results.

**Solution**

1<sup>st</sup> period

FullC approach

Sales revenue 4 000 · 50 EUR = 200 000 EUR

unit cost = variable unit cost + fixed overhead unit cost

$$unit\ cost = 30 + \frac{60\ 000}{5\ 000} = 30 + 12 = 42\ EUR$$

Table 3.2. Calculation of financial result on sales in the 1<sup>st</sup> period – FullC approach

Total manufacturing cost	4 000·42 EUR = 168 000 EUR
Administrative expense	6 000 EUR
Selling expense	4 000 EUR
Total costs of gaining receipts	178 000 EUR
Financial result on sales	22 000 EUR

Table 3.3. Calculation of financial result on sales in the 1<sup>st</sup> period – VarC approach

Sales revenue	4 000·50 EUR = 200 000 EUR
- Variable costs of sold products	4 000·30 EUR = 120 000 EUR
= Gross margin	80 000 EUR
- Fixed overhead costs	60 000 EUR
- Administrative expense	6 000 EUR
- Selling expense	4 000 EUR
Financial result on sales	10 000 EUR

2<sup>nd</sup> periodFullC approach

Sales revenue 4 800 · 50 EUR = 240 000 EUR

Manufacturing costs of products sold in the second period includes the inventory of products not sold in the previous period and current production products intended for sale. The valuation of sold products will follow FIFO (first in-first out) principle, i.e. according to consecutively manufactured products.

Beginning inventory 1 000 · 42 EUR = 42 000 EUR

Inventory of current production:  $unit\ cost = 30 + \frac{60\ 000}{4\ 000} = 30 + 15 = 45\ EUR$

Cost of manufacturing of current production products:

4 800 - 1 000 = 3 800 units,

3 800 · 45 EUR = 171 000 EUR

Table 3.4. Calculation of financial result on sales in the 2<sup>nd</sup> period – FullC approach

Total manufacturing cost of products sold	42 000+171 000 = 213 000 EUR
Administrative expense	6 000 EUR
Selling expense	4 000 EUR
Total costs of gaining receipts	223 000 EUR
Financial result on sales	17 000 EUR

Table 3.5. Calculation of financial result on sales in the 2<sup>nd</sup> period – VarC approach

Sales revenue	4 800·50 EUR = 240 000 EUR
- Variable costs of products sold	4 800·30 EUR = 144 000 EUR
= Gross margin	96 000 EUR
- Fixed manufacturing overhead costs	60 000 EUR
- Administrative expense	6 000 EUR
- Selling expense	4 000 EUR
Financial result on sales	26 000 EUR

## Management Accounting

### 3<sup>rd</sup> period

#### FullC approach

Sales revenue  $5\,500 \cdot 50 \text{ EUR} = 275\,000 \text{ EUR}$

Manufacturing cost:

Opening inventory  $200 \cdot 45 \text{ EUR} = 9\,000 \text{ EUR}$

Inventory of current production:

$$\text{unit cost} = 30 + \frac{60\,000}{5\,300} = 30 + 11.32 = 41.32 \text{ EUR}$$

Manufacturing cost of current production products:

$5\,500 - 200 = 5\,300$  units

$5\,300 \cdot 41.32 \text{ EUR} = 219\,000 \text{ EUR}$

Table 3.6. Calculation of financial result on sales in the 3<sup>rd</sup> period – FullC approach

Total manufacturing cost of products sold	$9\,000 + 219\,000 = 228\,000 \text{ EUR}$
Administrative expense	6 000 EUR
Selling expense	4 000 EUR
Total costs of gaining receipts	238 000 EUR
Financial result on sales	37 000 EUR

Table 3.7. Calculation of financial result on sales in the 3<sup>rd</sup> period – VarC approach

Sales revenue	$5\,500 \cdot 50 \text{ EUR} = 275\,000 \text{ EUR}$
- Variable costs of products sold	$5\,500 \cdot 30 \text{ EUR} = 165\,000 \text{ EUR}$
= Gross margin	110 000 EUR
- Fixed manufacturing overhead costs	60 000 EUR
- Administrative expense	6 000 EUR
- Selling expense	4 000 EUR
Financial result on sales	40 000 EUR

### Value of inventories

#### 1<sup>st</sup> period

FullC approach  $1\,000 \cdot 42 \text{ EUR} = 42\,000 \text{ EUR}$

VarC approach  $1\,000 \cdot 30 \text{ EUR} = 30\,000 \text{ EUR}$

#### 2<sup>nd</sup> period

FullC approach  $200 \cdot 45 \text{ EUR} = 9\,000 \text{ EUR}$

VarC approach  $200 \cdot 30 \text{ EUR} = 6\,000 \text{ EUR}$

### Comparison of the results and their interpretation

Table 3.8. Financial result on sale and value of inventories – summary

Period	Financial result on sale		Value of inventories	
	FullC approach	VarC approach	FullC approach	VarC approach
1 <sup>st</sup>	22 000	10 000	42 000	30 000
2 <sup>nd</sup>	17 000	26 000	9 000	6 000
3 <sup>rd</sup>	37 000	40 000	-	-
Total	76 000	76 000	x	x

**Conclusions:**

- If production > sales then → FR in to FullC approach > FR in VarC approach (1<sup>st</sup> period).
- If production < sales then → FR in to FullC approach < FR in VarC approach (2<sup>nd</sup> and 3<sup>rd</sup> period).
- If production = sales then → FR in to FullC approach = FR in VarC approach.
- However, with regard to the valuation of the inventories of unsold products, it should be stated that their value is always lower in VarC approach due to the adopted method of their valuation.

**4. Methods of costing**

Industries differ in their nature, in the products they manufacture and the services they offer. Hence, different methods of costing are used by different industries.

Some of the methods of costing are as follows:

- Simple division calculation,
- Equivalence number accounting,
- Process costing,
- Job order costing,
- Product-type cost accounting,
- Activity Based Accounting (ABC).

**4.1. Simple division calculation**

Simple division calculation is used for mass production of products using the same technology and equipment (i.e. production of wire, nails, wire mesh, packaging, sugar, beer etc.). As a result of the calculation, the average cost of manufacturing a product is obtained in each reporting period.

**Example 4.1.**

Table 4.1. Unit cost calculation

	Total production costs [EUR]	Quantity of finished goods [units]	Unit cost [EUR]
Direct materials	50 000	1 000	50
Direct labor	60 000	1 000	60
Overhead costs	45 000	1 000	45
Total			155

**4.2. Equivalence number accounting**

Equivalence number accounting is used in companies carry out mass production of various products, using the same raw material, the same production equipment and the same technological processes for all manufactured products (i.e. production of household chemicals, artificial fertilizers, sanitary fixtures, leather, various glass products, plastics, spirits, cosmetics).

**Example 4.2.**

The company manufactures, from the same raw material, three kinds of products: A, B and C. In the reporting period 800 items of products A, 600 items of products B and 400 items of products C were manufactured. The level of incurred costs is equal to 242 800 EUR, incl. material cost in the amount of 196 000 EUR.

Calculate unit costs of product A, B and C assuming that:

- material cost of the products are proportional to their weight: product A is twice as heavy as product B, product B is three times heavier than product C;
- the other costs are proportional to the time of work needed to manufacture these products: in order to manufacture product A four times less the amount of hours of work is needed than in the case of product B and five times less than in case of product C.

Table 4.2. Calculation of production costs

Product	Produced quantity (a)	Coefficient (b)	Quantity of coefficient units (c = a·b)	Cost of coefficient unit (d)	Cost of finished good (e = b·d)	Cost of production (f = a·e)
Materials cost 196 000 EUR				$\frac{196\,000}{7\,000} = 28$		
A	800	6	4 800		168	134 400
B	600	3	1 800		84	50 400
C	400	1	400		28	11 200
			Total 7 000			Total 196 000
Other costs 46 800 EUR				$\frac{46\,800}{5\,200} = 9$		
A	800	1	800		9	7 200
B	600	4	2 400		36	21 600
C	400	5	2 000		45	18 000
			Total 5 200			Total 46 800
Total costs						
A	800				177	141 600
B	600	-	-	-	120	72 000
C	400				73	29 200
						Total 242 800

**4.3. Process costing**

Process costing is used in those situations where manufacturing involves a single, homogeneous product that requires long manufacturing periods of time (for example flour, electricity, natural gas, cement, gas).

In order to calculate unit costs in a department, the department's equivalent units must be determined. Equivalent units can be computed in two ways: by the weighted-average method and by the FIFO method.

The activity in a department is summarized on a production report. This report consists of three parts:

1. Quantity schedule. It shows the flow of units through the department during a given period.
2. Computation of equivalent units and unit costs. Unit costs are provided individually for materials, labor and overhead as well as in total for the period.
3. Cost reconciliation. It summarizes all cost flows through the department for the period.

In most process costing situations weighted-average and FIFO methods will produce unit costs that are nearly the same. The exception perhaps will be in the case of raw materials. FIFO seems more complex but is superior to the weighted-average method from the cost control point of view. It is because FIFO focuses on current period costs.

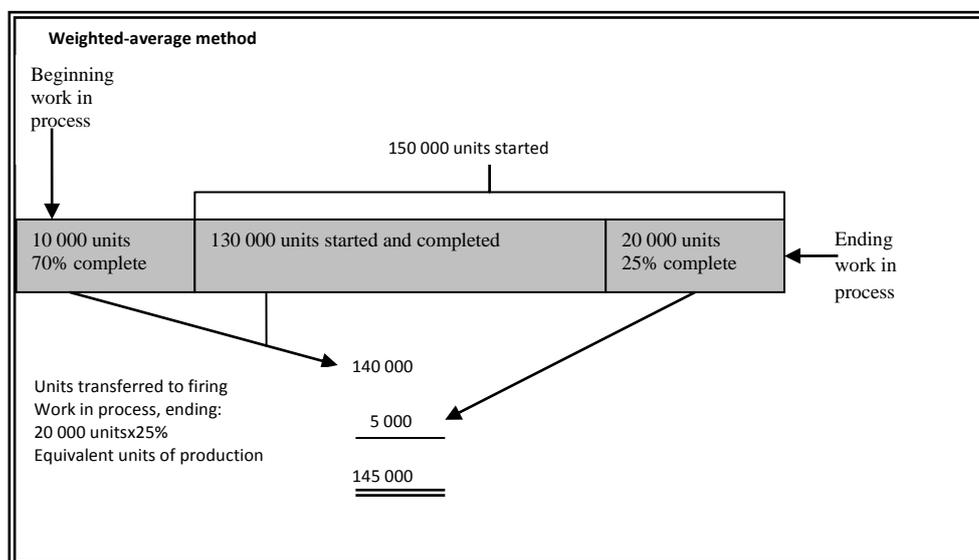


Figure 4.1. Visual perspective of equivalent units – weighted-average method [4]

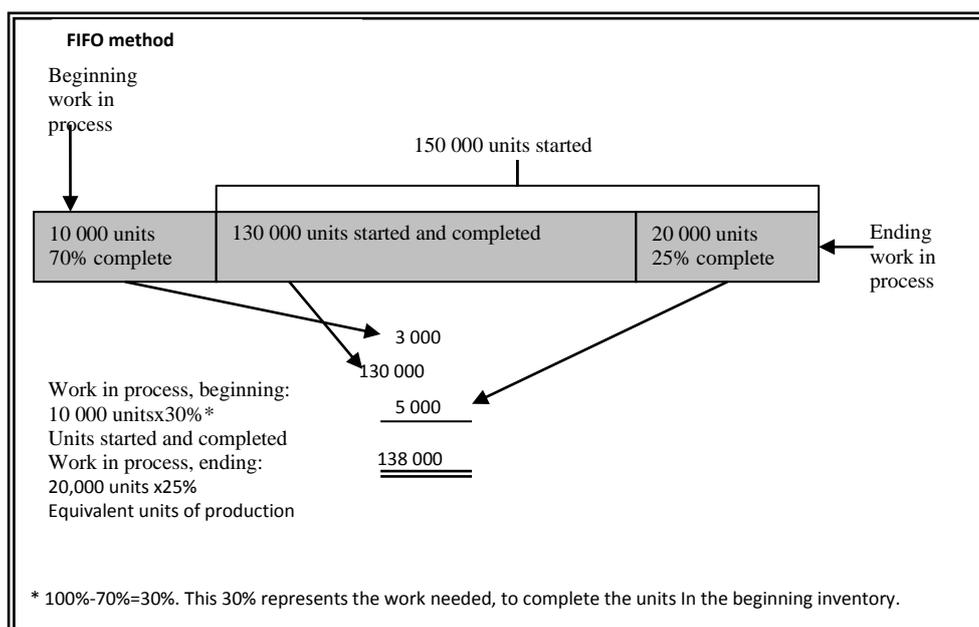


Figure 4.2. Visual perspective of equivalent units – FIFO method [4]

**Example 4.3.** [4]

The Stabler Chemical Company has two departments – mixing and cooking. Production activity begins in the mixing department; after mixing, the units are transferred to the cooking department. From cooking, the units are transferred to finished goods.

All of the materials involved in mixing are added at the beginning of work in the mixing department. Labor and overhead costs in that department are incurred uniformly as the work progresses. Overhead cost is applied at the rate of 150% of direct labor cost.

Table 4.3. Cost and other data for May 2021 – mixing department

Work in process, beginning:	
Units in process	20 000
Stage of completion*	30%
Cost the beginning inventory:	
Cost of Material	8 000 EUR
Labor cost	3 600
Overhead cost	5 400
Total cost in process	17 000 EUR
Units started into production during the month	180 000
Units completed and transferred to cooking	170 000
Costs added to production during the month:	
Cost of Material	63 000 EUR
Labor cost	88 000
Overhead cost applied	132 000
Work in process, ending:	
Units in process	30 000
Stage of completion*	40%

This refers to labor and overhead costs only, since all materials are added at the beginning of work in the mixing department.

Table 4.4. Production report – weighted average method

<b>1. Quantity schedule</b>				
<b>Units</b>				
Units to be accounted for:				
Work in process, beginning (all materials, 30% labor and overhead added last month)				20 000
Started into production				180 000
Total units to be accounted for				200 000
Units accounted for as follows:				
Transferred to cooking				170 000
Work in process, ending (all materials, 40% labor and overhead added this month)				30 000
Total units accounted for	200 000			

<b>2. Equivalent units<sup>1</sup> and unit costs</b>				
	Materials	Labor	Overhead	Total
Work in process, beginning	8 000 EUR	3 600 EUR	5 400 EUR	17 000 EUR
Cost added by the department	63 000	88 000	132 000	283 000
Total cost (a)	71 000 EUR	91 600 EUR	137 400 EUR	300 000 EUR
Equivalent units:				
Units transferred out	170 000	170 000	170 000	
Work in process, ending	30 000	40%·30000 = 12000	40%·3000 = 12000	
Total equivalent units (b)	200 000	182 000	182 000	
Unit cost, (a)-(b)	0.355 EUR	0.503 EUR	0.755 EUR	1.613 EUR
<b>3. Cost reconciliation</b>				
	Equivalent units (EU)			Costs
Cost to be accounted for:				
Work in process, beginning				17 000 EUR
Cost added by the department				283 000
Total cost to be accounted for				300 000 EUR
Cost accounted for as follows:				
Transferred to cooking: 170 000 units·1.613 EUR				274 254 EUR
Work in process, closing:				
Materials, at 0.355 EUR per EU	30 000			10 650
Labor, at 0.503 EUR per EU		12 000		6 036
Overhead, at 0.755 EUR per EU			12 000	9 060
Total work in process, ending				25 746
Total cost accounted for				300 000 EUR

Table 4.5. Production report – FIFO method

<b>1. Quantity schedule</b>				
<b>Units</b>				
Units to be accounted for:				
Work in process, beginning (all materials, 30% labor and overhead added last month)				20 000
Started into production				180 000

<sup>1</sup> An **equivalent unit of production** is an expression of the amount of work done by a manufacturer on **units of output** that are partially completed at the end of an accounting period. Basically the fully completed **units** and the partially completed **units** are expressed in terms of fully completed **units**.

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Total units to be accounted for				200 000
Units accounted for as follows:				
Transferred to cooking:				
Units from the beginning inventory				20 000
Units started and completed this month				170 000-20 000 = 150 000
Work in process, ending (all materials, 40% labor and overhead added this month)				30 000
Total units accounted for	200 000			
<b>2. Equivalent units and unit costs</b>				
	Materials	Labor	Overhead	Total
Cost added by the department (a)	63 000 EUR	88 000 EUR	132 000 EUR	283 000 EUR
Equivalent units:				
Work in process, beginning	-	14 000*	14 000*	
Started and completed this month	150 000	150 000	150 000	
Work in process, ending	30 000	40%·30units = 12 000EU	40%·30units = 12 000EU	
Total equivalent units (b)	180 000	176 000	176 000	
Unit cost, (a)-(b)	0.35 EUR	0.50 EUR	0.75 EUR	1.60 EUR
<b>3. Cost reconciliation</b>				
	Equivalent units (EU)			Costs
Cost to be accounted for:				
Work in process, beginning				17 000 EUR
Cost added by the department				283 000
Total cost to be accounted for				300 000 EUR
Cost accounted for as follows:				
Transferred to cooking:				
Units from the beginning inventory:				
Cost in the beginning inventory				17 000 EUR
Cost to complete these units:				
Materials, at 0.35 EUR per EU	-			-
Labor, at 0.50 EUR per EU		14 000		7 000
Overhead, at 0.75 EUR per EU			14 000	10 500
Total cost				34 500
Units started and completed during the month:	-	-	-	240 000
150 000 units·1.60 EUR				
Total cost transferred				274 500
Work in process, ending:				
Materials, at 0.35 EUR per EU	30 000			10 500

Labor, at 0.50 EUR per EU		12 000		6 000
Overhead, at 0.75 EUR per EU			12 000	9 000
Total work in process, closing				25 500
Total cost accounted for				300 000 EUR

\*100% - 30% = 70%; 70% 20 000 units = 14 000 EU

#### 4.4. Job order costing

Job order costing is used in situations where an organization offers many different products or services i.e. furniture manufacturing, ship building, equipment manufacturing. Job order costing is also used in service industries like hospitals, law firms, accounting firms. Job order costing is a system in which distinct unit costs can be determined for each job completed. Materials requisition forms and labor time tickets are used to assign direct materials and direct labor costs to jobs in a job costing system. Manufacturing overhead costs are assigned to jobs through use of a predetermined overhead rate. The predetermined overhead rate is determined before the period begins by dividing the estimated total manufacturing cost for the period by the estimated total allocation base for the period. The most frequently used allocation bases are direct labor-hours and machine-hours.

$$\text{predetermined overhead rate} = \frac{\text{estimated total manufacturing overhead costs}}{\text{estimated total units in the base (MH, DLH, etc.)}}$$

Overhead is applied to jobs by multiplying the predetermined overhead rate by the actual amount of the allocation base used by the job. Since the predetermined overhead rate is based on estimates, the actual overhead cost incurred during the period may be more or less than the amount of the overhead cost applied to the production. Such a difference is referred to as under- or overapplied overhead. The under- or overapplied overhead for the period can be either (1) closed out to Cost of Goods Sold or (2) allocated between Work in Process, Finished Goods and Cost of Goods Sold. When the overhead is under applied, the manufacturing overhead costs have been understated and therefore the inventories and/or the expenses must be adjusted upwards. When the overhead is overapplied, the manufacturing overhead costs have been overstated and therefore the inventories and/or the expenses must be adjusted downwards.

Table 4.6. Differences between job order and process costing [4]

	Job order costing	Process costing
1.	Many different jobs are worked on during each period, with each job having different production requirements.	A single product is manufactured either on a continuous basis or for long periods of time. All units of product are identical.
2.	Costs are accumulated by individual jobs.	Costs are accumulated by a department.
3.	The job cost sheet is the key document controlling the accumulation of costs by a job.	The department production report is the key document showing the accumulation and disposition of costs by a department.
4.	Unit costs are computed by the job on the job cost sheet.	Unit costs are computed by the department on the department production report.

**Example 4.4.**

SUNNY DAYS Company manufactures three types of garden sheds. Manufacturing costs are gathered using three separate orders, namely:

- order 10 – 5 units,
- order 11 – 2 units,
- order 12 – 3 units.

Table 4.7. Production costs

Specification	Order 10	Order 11	Order 12	Total
Direct materials [in EUR]	14 000	16 000	20 000	50 000
Direct labor [in EUR]	24 000	12 000	8 000	44 000
Manufacturing overhead [in EUR]				79 200
Management costs [in EUR]				64 000

All orders are completed.

Manufacturing overhead costs are assigned to orders on machine-hours basis:

- order 10 – 1 000 mh,
- order 11 – 275 mh,
- order 12 – 375 mh.

Management costs are proportional to manufacturing cost.

Calculate unit manufacturing cost of a garden shed of each order.

Total mh – 1 650 mh

$$\text{Overhead rate} = \text{Overhead costs} / \text{total mh} = 79\,200 \text{ EUR} / 1\,650 \text{ mh} = 48 \text{ [EUR/mh]}$$

Table 4.8. Manufacturing overhead

Order	Manufacturing overhead [EUR]
10	$48 \cdot 1\,000 = 48\,000$
11	$48 \cdot 275 = 13\,200$
12	$48 \cdot 375 = 18\,000$

173 200 – 100

$$86\,000 - x \rightarrow x = 49.7\% \text{ management costs for order } 10 = 49.7\% \cdot 64\,000 = 31\,808$$

173 200 – 100

$$41\,200 - x \rightarrow x = 23.8\% \text{ management costs for order } 11 = 23.8\% \cdot 64\,000 = 15\,232$$

173 200 – 100

$$46\,000 - x \rightarrow x = 26.5\% \text{ management costs for order } 12 = 26.5\% \cdot 64\,000 = 16\,960$$

Table 4.9. Manufacturing costs of orders

Specification	Order 10	Unit cost	Order 11	Unit cost	Order 12	Unit cost	Total
	[in EUR]						
Direct materials	14 000	2 800	16 000	2 800	20 000	6 666.6	50 000
Direct labor	24 000	4 800	12 000	6 000	8 000	2 666.6	44 000
Manufacturing overhead	48 000	9 600	13 200	6 600	18 000	6 000	79 200
Manufacturing cost	86 000	17 200	41 200	20 600	46 000	15 333.2	173 200
Management costs	31 808	6 361.6	15 232	7 616	16 960	5 653.3	64 000
Total manufacturing costs	117 808	23 561.6	56 432	28 216	62 960	20 986.5	237 200

#### 4.5. Product-type cost accounting

Product-type cost accounting is used in serial and complex multi-series production. The subject of the calculation is a specific assortment of manufactured products, for which an appropriate recording device is opened to recognize the costs associated with the production of a given assortment. It makes it possible to determine the unit cost in a given period, regardless of the size and number of orders.

#### Example 4.5.

The company manufactures two assortments of finished products A and B.

Table 4.10. Prime costs of production [in EUR]

Specification	Product A	Product B	Total
Direct materials	14 000	24 000	38 000
Direct labor	6 000	10 000	16 000
Total	20 000	34 000	54 000

Overhead costs incurred in the current reporting period amounted to 32 000 EUR, the settlement of which is based on the sum of direct labor.

In the current period 500 units of finished products A, 200 units of unfinished products A (processed in 50% from the point of view of the incurred processing costs) and 1 000 units of finished product B were manufactured.

1. Overhead markup calculation:

$$\text{overhead markup} = \frac{\text{overhead costs}}{\text{labor costs}} \cdot 100\% = \frac{32\,000}{16\,000} \cdot 100\% = 200\%$$

2. Division of overhead costs into assortments of products:

Product A:  $6\,000 \cdot 200\% = 12\,000$

Product B:  $10\,000 \cdot 200\% = 20\,000$

Total 32 000

3. Production quantity:

Finished product A

500 units processed in 100% = 500 equivalent units

200 units processed in 50%= 100 equivalent units

Finished product B

1 000 units processed in 100% = 1 000 equivalent units

Table 4.11. Calculation of unit costs

Specification	Finished Product A				Finished Product B		
	Costs incurred in the period	quantity	Unit manufacturing cost		Costs incurred in the period	quantity	Unit manufacturing cost
			finished product	unfinished product			
Direct materials	14 000	700	20	20	24 000	1 000	24
Direct labor	6 000	600	10	5	10 000	1 000	10
Overhead costs	12 000	600	20	10	10 000	1 000	10
Total	32 000	-	30	35	27	-	34

**4.6. Activity Based Costing (ABC)**

Activity Based Costing is an accounting technique that allows an organization to determine the actual cost associated with each product manufactured and service rendered by the organization without regard to the organizational structure. ABC is based on the principle that “products consume activities”. Traditional cost systems allocate costs based on direct labor, cost of materials, revenue or other simplistic methods. As a result, traditional systems overestimate costs of high volume products, services and customers and underestimate costs of low volume. ABC allocation methods are frequently called cost drivers. Several steps of application of ABC method can be listed as follows:

1. identify activities (for example: set up, receiving, packing, engineering),
2. determine cost for each activity,
3. determine cost drivers (i.e. number of setups, machine-hours, number of receipts, number of deliveries, engineering hours),
4. collect activity data,
5. calculate product cost.

With the costing based on activities, the cost of serving a customer can be ascertained individually. Deducting the product cost and the cost to serve each customer, one can arrive at customer’s profitability. This method of dealing with customer cost and product cost separately has lead to identifying the profitability of each customer and to position products and services accordingly.

**Example 4.6.**

Using the following information calculate product unit cost under ABC accounting method.

JOKER Company manufactures three kinds of products. Last month the sales level was:

- 8 000 units of product X,
- 10 000 units of product Y,
- 6 000 units of product Z.

Table 4.12. Prime costs

	X	Y	Z
Direct materials	20	18	10
Direct labor	16	12	10

Product X requires 4 machine-hours (mh),  
 product Y – 2 mh,  
 product Z – 6 mh.  
 Total machine-hours is 40 000.

Table 4.13. Types of activities and cost drivers

Type of activity	Cost of activity [EUR]	Cost drivers
Production engineering	40 000	Number of production series
Maintenance	80 000	Number of machine-hours
Deliveries of materials	60 000	Number of deliveries of materials
Packaging	45 000	Number of consignments
Technical service	64 000	Number of production orders

Table 4.14. Quantity of activities needed to manufacture particular products

Specification	Product X	Product Y	Product Z	Total
Number of production series	6	8	11	25
Number of consignments	16	8	26	50
Number of deliveries of materials	18	20	42	80
Number of production orders	15	21	28	64

Table 4.15. Activity unit cost calculation

Type of activity	Cost of activity [EUR]	Number of activities	Unit cost of activity
Production engineering	40 000	25	1600
Maintenance	80 000	40 000	2
Deliveries of materials	60 000	80	750
Packaging	45 000	50	900
Technical service	64 000	64	1000

Unit cost will be calculated using the following equation:

$$\text{unit cost} = \frac{\text{number of activities} \cdot \text{unit cost of activity}}{\text{number of products}}$$

Table 4.16. Unit costs of products

	Product X	Product Y	Product Z
Direct materials	20	18	10
Direct labor	16	12	10
Production engineering	$\frac{6 \cdot 1\,600}{8\,000} = 1.2$	$\frac{8 \cdot 1\,600}{10\,000} = 1.28$	$\frac{11 \cdot 1\,600}{6\,000} = 2.93$
Maintenance	$4 \cdot 2 = 8$	$2 \cdot 2 = 4$	$6 \cdot 2 = 12$
Deliveries of materials	$\frac{18 \cdot 750}{8\,000} = 1.69$	$\frac{20 \cdot 750}{10\,000} = 1.5$	$\frac{42 \cdot 750}{6\,000} = 5.25$
Packaging	$\frac{16 \cdot 900}{8\,000} = 1.8$	$\frac{8 \cdot 900}{10\,000} = 0.72$	$\frac{26 \cdot 900}{6\,000} = 3.9$
Technical service	$\frac{15 \cdot 1\,000}{8\,000} = 1.875$	$\frac{21 \cdot 1\,000}{10\,000} = 2.1$	$\frac{28 \cdot 1\,000}{6\,000} = 4.67$
Total	50.565	39.6	13.82

### 5. Break-Even Point (BEP) analysis

Break-Even Point analysis determines the break-even sales which is the units and/or sales revenue, where total sales revenue equals total costs (expenses).

Assuming linear functions we get:

$$S = p \cdot q,$$

where:

$S$  – revenue on sales,

$q$  – quantity of manufactured and sold products,

$p$  – unit price

and

$$TC = F + q \cdot v,$$

where:

$TC$  – total costs,

$F$  – fixed costs,

$v$  – variable cost per unit.

To find BEP we have to compare sales to total cost:

$$S(q_0) = TC(q_0)$$

This equation can be presented as:

$$p \cdot q_0 = F + q_0 \cdot v$$

After conversion we get:

$$q_0 = \frac{F}{(p - v)}$$

When production quantity is lower than the Break-Even Point  $q < q_0$ , the loss will be generated. Otherwise, when  $q > q_0$  the production and sale will generate profit.

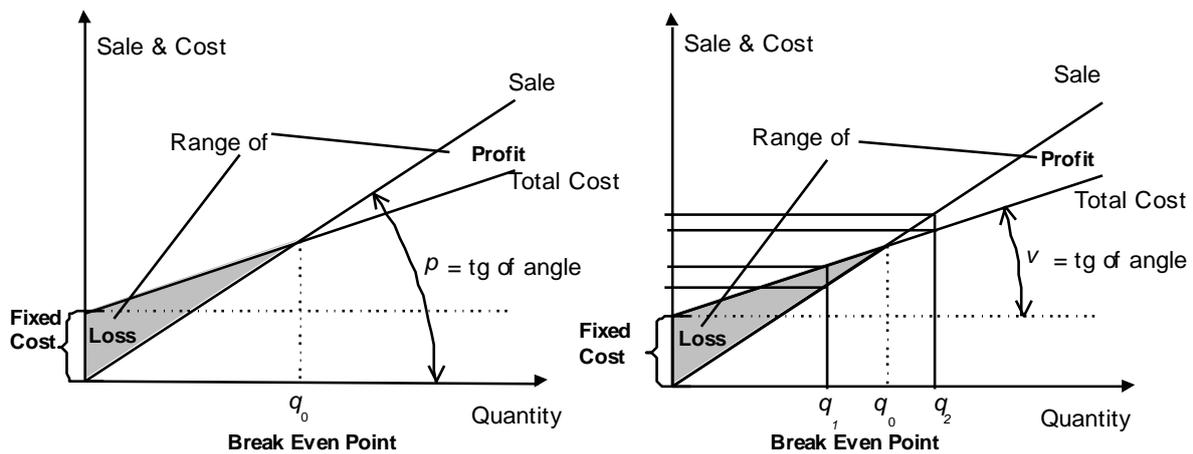


Figure 5.1. Break-Even Point [8, 9]

In situation, when there is a possibility to run the production without additional investment outlay  $q_2 > q_0$  products and when, according to marketing research, there is a demand for this quantity of products at price  $p$ , the company will generate profit.

When the company's production capacity allows to run the production at most  $q_1 < q_0$  products, or when there is a demand only for this quantity at price  $p$ , then the company will generate loss. In this situation the following possibilities have to be considered: increase in unit price, decrease in unit variable costs, decrease in fixed costs [9].

**Margin of safety** is the level of actual sales above the Break-Even Point. In other words it is the gap between the estimated sales output and the level by which the company's sales could decrease before the company will become unprofitable. It signals the risk of loss that may happen as the business is subjected to changes in sales. A high spread of margin secures the company against variations in sales.

$$\text{Margin of Safety (in units)} = \text{Current Sales Units} - \text{Breakeven Point}$$

$$\text{Margin of Safety (in monetary unit f. e. EUR)} = \text{Current Sales} - \text{Breakeven Sales}$$

$$\text{Margin of Safety (in \%)} = \frac{\text{Current Sales Level} - \text{Breakeven Point}}{\text{Current Sales Level}} \cdot 100$$

### Example 5.1.

In the sand extraction company data on the extraction of  $1 \text{ m}^3$  of sand are as follows:

- unit selling price 30 EUR/ $\text{m}^3$ ,
- unit variable cost 20 EUR/ $\text{m}^3$ ,
- fixed costs per month 100 000 EUR.

a) Calculate:

- BEP (in units and as sales value),
- margin of safety if the planned sand extraction is  $15\,000 \text{ m}^3$ ,
- financial result for the planned sand extraction.

b) How much sand must be sold to achieve a monthly profit of 20 000 EUR?

c) Calculate BEP in case of unit variable cost increase by 10%.

d) Calculate BEP for a 20% decrease in fixed costs.

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$$\begin{aligned} \text{a) } \quad BEP &= \frac{100\,000}{30-20} = 10\,000 m^3 \\ BEP' &= 10\,000 \cdot 30 = 300\,000 \text{ EUR} \end{aligned}$$

$$\text{Margin of Safety (in units)} = 15\,000 - 10\,000 = 5\,000 m^3$$

$$\text{Margin of Safety (in EUR)} = 15\,000 \cdot 30 - 10\,000 \cdot 30 = 150\,000 \text{ EUR}$$

$$\text{Margin of Safety (in \%)} = \frac{15\,000 - 10\,000}{15\,000} = 33\%$$

$$\text{Financial Result} = \text{Sales Revenue} - \text{Total costs} = 15\,000 \cdot 30 - (100\,000 + 15\,000 \cdot 20) = 50\,000 \text{ EUR}$$

$$\begin{aligned} \text{b) } \quad 20\,000 &= q \cdot 30 - (100\,000 + q \cdot 20) \\ q &= 12\,000 m^3 \end{aligned}$$

$$\begin{aligned} \text{c) } \quad v &= 20 \cdot 1.1 = 22 \text{ EUR}/m^3 \\ BEP &= \frac{100\,000}{30 - 22} = 12\,500 m^3 \\ BEP' &= 12\,500 \cdot 30 = 375\,000 \text{ EUR} \end{aligned}$$

$$\begin{aligned} \text{d) } \quad F &= 100\,000 - 0.2 \cdot 100\,000 = 80\,000 \text{ EUR} \\ BEP &= \frac{80\,000}{30 - 20} = 8\,000 m^3 \\ BEP' &= 8\,000 \cdot 30 = 240\,000 \text{ EUR} \end{aligned}$$

For the planned sand extraction, the company generates profit of 50 000 EUR. Sales can drop a maximum of 33% in order not to fall into the loss zone. An increase in unit costs increases BEP, and a decrease in fixed costs reduces it.

## 6. Operating and financial leverage

Operating leverage is an indication of how a company's costs are structured. Financial leverage refers to the amount of debt used to finance the operations of a company.

### 6.1. Operating leverage

**Operating leverage** magnifies the financial performance of a business. Operating leverage depends on the company's cost structure which is based on the composition of fixed costs and variable costs.

Operating leverage demonstrates influence of sales value ( $S$ ) or sales quantity ( $q$ ) on Earnings Before Interests and Taxes ( $EBIT$ ). To assess this influence we have to find simple  $EBIT$  dependence on:

- Quantity of sale ( $q$ ),
- Product unit price ( $p$ ),
- Sales value ( $S$ ),
- Cost ( $TC$ ).

$$EBIT = f(q, p, S, TC)$$

Degree of financial leverage (DOL) is defined as a multiplier of fixed costs usage, namely:

$$DOL(S) = \frac{\% \text{ change in EBIT}}{\% \text{ change in sales}} = \frac{\frac{\Delta EBIT}{EBIT}}{\frac{\Delta S}{S}}$$

Another equation of DOL is:

$$DOL(S) = \frac{S-V}{EBIT},$$

where:

*EBIT* – Earnings Before Interests and Taxes,

*S* – sales value,

*V* – variable costs.

It is obvious that the value of DOL depends on the sales level for which it is calculated. If only the unit price of the product is the same (*p*) in the considered period, the sales level can be expressed as a value or as a quantity.

$$DOL(S) = DOL(q \cdot p)$$

When variable unit cost equals *v*, the operating variable costs are  $V = q \cdot v$

and

$$DOL(q) = \frac{S-V}{EBIT} = \frac{p \cdot q - v \cdot q}{p \cdot q - F - v \cdot q} = \frac{q \cdot (p - v)}{q \cdot (p - v) - F}$$

It can be seen that operating leverage is a function of sales value *S* (and therefore the quantity of sold products). If the sales value changes the value of operating leverage calculated for a new sales level will be different. The graph shows the operating leverage as hyperbola. Horizontal asymptote equals "1" and vertical asymptote equals the break-even point (BEP), Figure 6.1.

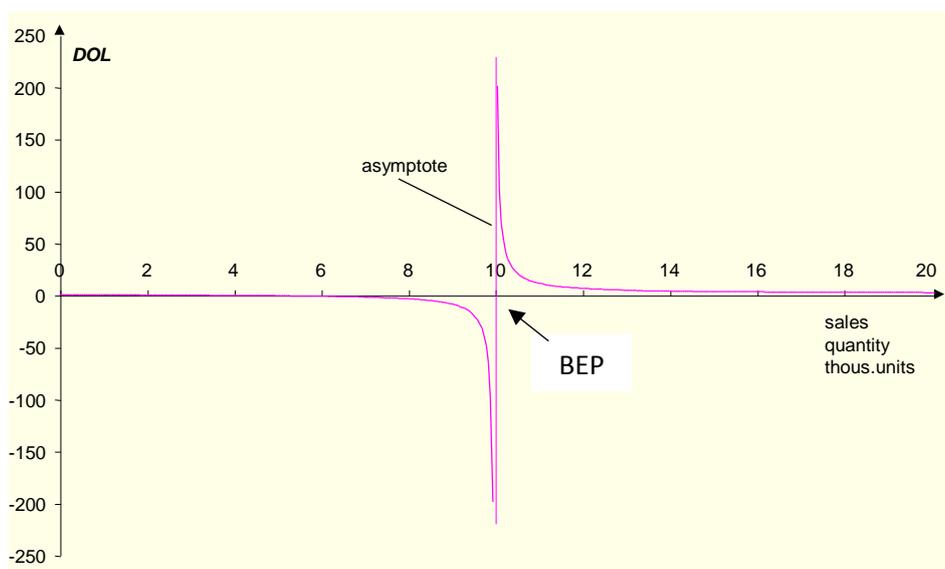


Figure 6.1. DOL dependence on the sales quantity [9]

It must be pointed out that for production quantity which is the company break-even point, the value of DOL is undefined because in this point EBIT = 0. For production quantity below break-even point DOL is negative which means that loss reduction (EBIT is negative) is proportional to DOL.

On the right from BEP the value of DOL is decreasing to 1 when the sales level increases. This is a disadvantageous effect. It causes that in near BEP – a few percent of change in BEP causes a relatively big increase in EBIT whereas further from BEP the same percentage increase in the sales level causes smaller percentage increase in EBIT.

To increase the operating leverage effect further from BEP the company must approach BEP to the current level of sale. It can be done by decreasing the variable costs and increasing the fixed costs: for example a new technology implementation (new machinery and devices that reduce labor costs) [9].

**Example 6.1.**

Table 6.1. Income Statements before and after change in sales value [9]

	Before change	After	% change
Sales	5 000 000	5 500 000	+ 10%
Variable operating costs (60% <sup>2</sup> )	3 000 000	3 300 000	+ 10%
Fixed operating costs	1 000 000	1 000 000	0%
Total operating costs	4 000 000	4 300 000	+ 7.5%
EBIT	1 000 000	1 200 000	+ 20%
Interests	250 000	250 000	+ 0%
EBT	750 000	950 000	+ 26.7%
Tax 40%	300 000	380 000	+ 26.7%
EAT	450 000	570 000	+ 26.7%

Operating leverage for 5 000 000 EUR sales level and 500 000 EUR sales increase is:

$$DOL (5\,000\,000) = \frac{\frac{\Delta EBIT}{EBIT}}{\frac{\Delta S}{S}} = \frac{\frac{1\,200\,000\,EUR - 1\,000\,000\,EUR}{1\,000\,000\,EUR}}{\frac{5\,500\,000\,EUR - 5\,000\,000\,EUR}{5\,000\,000\,EUR}}$$

$$= \frac{200\,000\,EUR}{1\,000\,000\,EUR} \cdot \frac{5\,000\,000\,EUR}{500\,000\,EUR} = 2.0$$

or

$$DOL (5\,000\,000) = \frac{S - V}{EBIT} = \frac{5\,000\,000\,EUR - 3\,000\,000\,EUR}{1\,000\,000\,EUR} = 2.0$$

---

<sup>2</sup> Index of operating variable costs participation in the sale value is 60%. It is assumed that there is a linear dependency of cost function and sales value.

DOL equalled 2.0. This means that 1% change in the sales level causes the double change in EBIT. What's more these changes are in the same direction. The increase in sales causes the double increase in EBIT and inversely the decrease in sales causes the double decrease in EBIT. Because the sales increased by 10% and  $DOL = 2.0$ , we can conclude that EBIT should have increased by  $2.0 \cdot 10\% = 20\%$ , which in fact is true. Now it is easy to calculate the percentage increase in EBIT for any percentage increase in sales [9].

## 6.2. Financial leverage

Financial leverage means the presence of debt in the capital structure of a company. The fixed-charge bearing capital (like preference shares, debentures, term loans etc.) is used to increase the profit intended for the owners (i.e. shareholders).

The company's financial leverage is represented by the change in Earnings per Share (EPS), which occurs as a result of the change in Earnings Before Interests and Taxes (EBIT).

Figure 6.2. illustrates the concept of financial leverage.

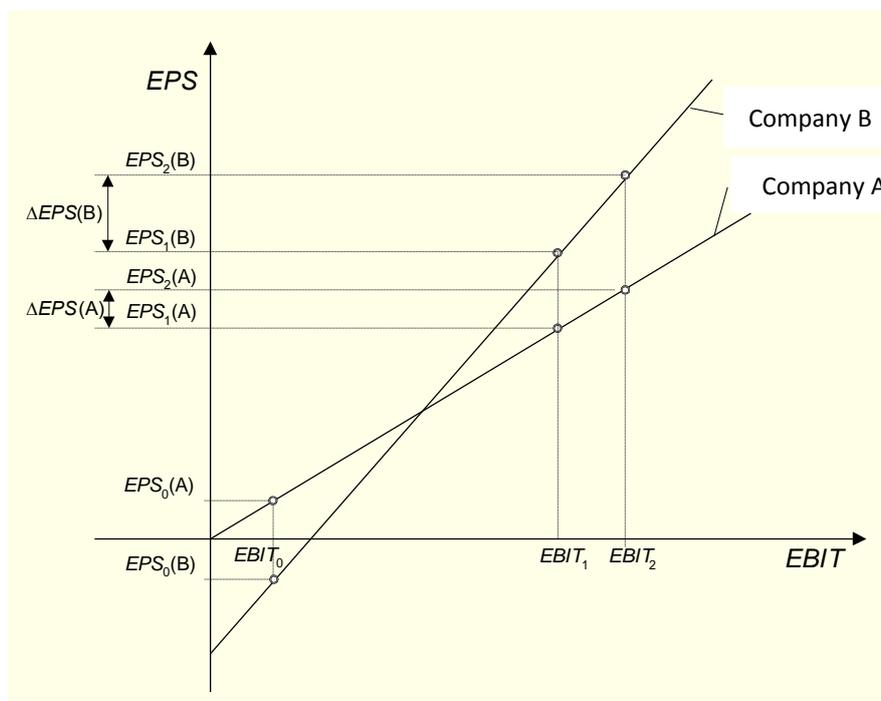


Figure 6.2. Financial leverage [9]

Company A finances its activities only with equity, without fixed-cost funds. Company B, in addition to equity, also uses fixed-cost external funds. The relationship between EBIT and EPS for company A is represented by line A, for company B by line B. Figure 6.2. shows that the tangent of the slope of line A is less than the tangent of the slope of line B.

Thus, a change in EBIT

$$\Delta EBIT = EBIT_2 - EBIT_1 \text{ causes a change in EPS in company A}$$

$$\Delta EPS(A) = EPS_2(A) - EPS_1(A), \text{ and a change in EPS in company B}$$

$$\Delta EPS(B) = EPS_2(B) - EPS_1(B), \text{ where } \Delta EPS(B) > \Delta EPS(A).$$

In a company financed only with share capital the impact of a change in EBIT on EPS is weaker than in a company financed with equity and long-term debt.

Moreover, it can be seen that in the case of a relatively high EBIT level, for example  $EBIT_2$ , the use of leverage in company B increases the EPS level above the level of EPS (A) for the company not using borrowed financing. On the other hand, for a relatively low EBIT level, for example  $EBIT_0$  in Figure 6.2, the inverse relationship is obtained.

In company B financed with share and debt capital,  $EPS_0(B) < EPS_0(A)$ , and even  $EPS_0(B) < 0$ . The degree of financial leverage is the proportion of a percentage change in EPS due to a certain percentage change in EBIT.

$$DFL(EBIT) = \frac{\% \text{ change in EPS}}{\% \text{ change in EBIT}} = \frac{\frac{\Delta EPS}{EPS}}{\frac{\Delta EBIT}{EBIT}}$$

Sometimes it is more convenient to use the following definition of DFL:

$$DFL(EBIT) = \frac{EBIT}{EBIT - I - D_p / (1 - T)}$$

where:

$I$  – debt interest,

$D_p$  – preferred dividend,

$T$  – interest rate.

If the company does not have capital from preference shares,

$$DFL(EBIT) = \frac{EBIT}{EBIT - I - D_p / (1 - T)} = \frac{EBIT}{EBIT - I} = \frac{EBIT}{EBT}$$

where:

$EBT$  – Earnings Before Tax.

Financial leverage is a function of EBIT, so its value is different for each EBIT value.

The graph of financial leverage as a function of operating profit is represented by a hyperbola. The horizontal asymptote is a straight line with a value equal to 1. The vertical asymptote is a straight line at the point  $EBIT = I$ , i.e. at the point where EBIT is sufficient only for interest on debt capital (Figure 6.3). It makes sense to use leverage only to the right from this point, or in other words, it makes no sense to use so large external capital that the interest on it exceeds the generated operating profit. In practice, the operating profit should be significantly higher than the interest on debt capital.

### Example 6.2.

Manager of BARR Company received an instruction to estimate the financial leverage for various EBIT levels.

Table 6.2. EPS calculations for BARR Company [9]

	in [EUR]						
<i>EBIT</i>	0	200 000	400 000	500 000	800 000	1 000 000	1 200 000
Interest	25 000	250 000	250 000	250 000	250 000	250 000	250 000
<i>EBT</i>	-250 000	-50 000	150 000	250 000	550 000	750 000	950 000
Tax	0	0	60 000	100 000	220 000	300 000	380 000
<i>EAT</i>	-250 000	-50 000	90 000	150 000	330 000	450 000	570 000
Preferred dividend	150 000	150 000	150 000	150 000	150 000	150 000	150 000
Profit for shareholders	-400 000	-200 000	-60 000	0	180 000	300 000	420 000
<i>EPS</i>	-4.0	-2.0	-0.6	0	1.8	3.0	4.2
<i>DFL</i>	-	-0.7	-4	undefined	2.7	2.0	1.7

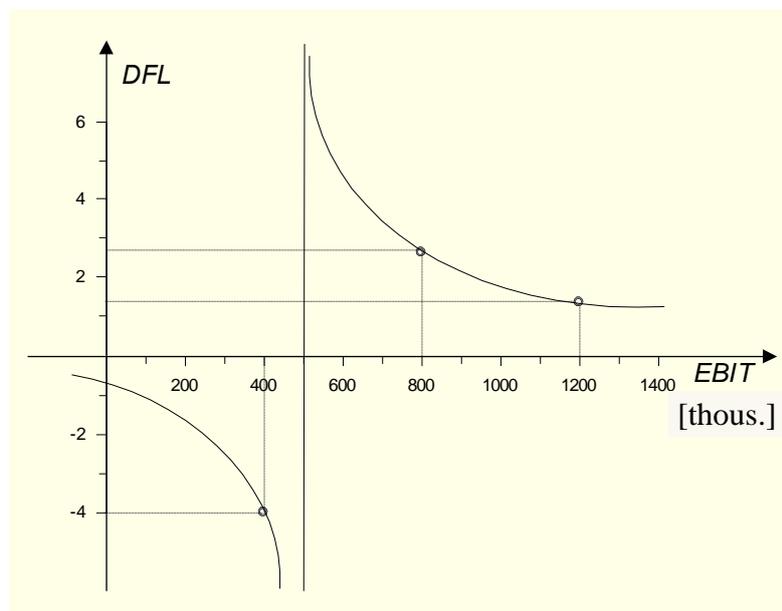


Figure 6.3. DFL (EBIT) relationship for BARR Company [9]

It means that for  $EBIT=1\,000\,000$  EUR, when  $DFL = 2.0$ , an increase in EBIT by 10% will result in a 20% increase in EPS, and similarly, a decrease in EBIT by 10% will result in a decrease in EPS by 20%. The sales volume for which EBIT equals 500 000 EUR covers only the fixed costs of external funds, generating zero profit for ordinary shareholders. DFL cannot be specified at this point.

In the case under consideration, for EBIT lower than 500 000 EUR, the DFL is negative and the lower the DFL (greater absolute value), the greater the reduction of EPS losses.

An enterprise may influence the DFL value by reducing or increasing the cost of debt (the number of preferred shares issued) or by creating an appropriate company capital structure understood as the proportion of debt relative to equity in a company's total assets [9].

Lecturer:

**Joanna Szczepańska, PhD**

e-mail address: [joanna.szczepanska@pwsz.nysa.pl](mailto:joanna.szczepanska@pwsz.nysa.pl)