Betriebswirtschaftliches
Institut & Seminar Basel

ACCOUNTING II:
COST AND OUTPUT ACCOUNTING SYSTEM

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1. AN OVERVIEW OF ACCOUNTING

1.1 Introduction

Companies produce goods and/or services, for the purpose of selling them. The production of these goods and/or services; i.e., the operational process, necessitates the utilisation of productive resources and assets. Productive resources and assets comprise all the goods which are applied to the production process (= material goods, services, energy input). The goods applied are also called input goods. Productive resources and assets can be distinguished by various criteria. In the context of accounting, the following categorisation makes sense:

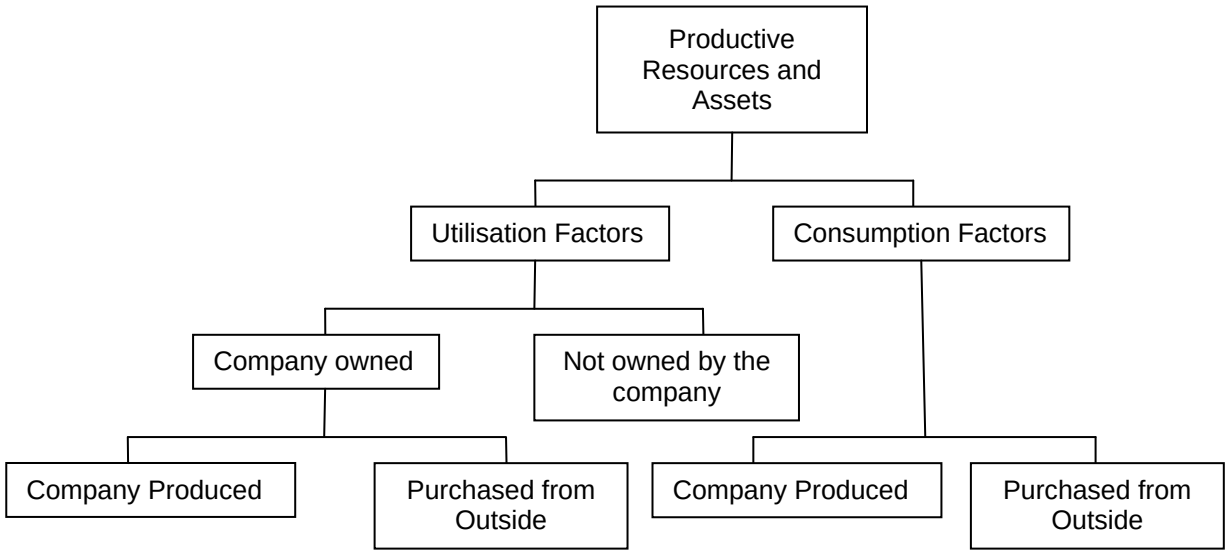


fig: Categorisation of productive resources and assets by utilisation and consumption factors.

The distinction is made according to:

- whether the productive resource is immediately consumed in the production process or whether it is available to the company for a longer period of time,
- whether the productive resource belongs to the company or whether it is put at the company's disposal for a defined period of time according to the terms of contract,
- whether the productive resource was produced by the company or purchased from an outside source.

In the course of the production of goods and/or services the available input goods (=productive resources and assets) are transformed into output goods. Goods are produced and sold with the objective of making a profit. In order to obtain the highest possible profit yield, the application of productive resources and assets complies with the following principles:

- To obtain the greatest possible yield (volume of goods and/or services produced) by employing a given set of means (=*Principle of Maximisation*) or
- To obtain a particular yield (volume of goods and/or services produced) or a particular aim by employing the least amount of productive resources and assets (= *Principle of Minimisation*).

Hence, the main company objective is the realisation of profits. However, other subsidiary objectives, such as liquidity securing, the growth of the company, the safeguarding of employment, etc., are pursued in parallel. An economically efficient and targeted management of the company is only possible if cost accounting is available and applied as a management and controlling tool.

Cost accounting is the systematic, regular and/or case-related recording, processing, assessment and transmission of the quantitative data resulting from company operations (= measures of quantity and value). The objective of cost accounting is the utilisation of these quantitative data for the purpose of intracompany planning, management and controlling and for the purpose of providing information to and influencing external related parties to the company.

1.2. Tasks

The main tasks of cost accounting can be divided into the subsidiary areas of “external reporting” and “internal presentation”. However, this cannot be accomplished by means of a single calculation as the goals pursued by external reporting are different from those of the internal presentation.

1.2.1. The Outward View

Documentation and Reporting:
All business transactions are put into a chronological and factual order on the basis of documents so that the company's asset, liability and income situation can be presented and reported to owners, creditors, trade unions and the general public alike.

Taxation Basis:
Accounting forms the basis of the calculation of income tax or corporate tax, respectively, as well as other taxes.

The aims pursued by the outward presentation are either to

- give a pessimistic evaluation of the company's situation although it is excellent in order to avoid high dividend payments to the owners (shareholders) or excessive tax payments to Inland Revenue or to
- give an optimistic view of the company's situation although it is rather bad in order to keep the owners and creditors interested.

1.2.2. The Inward View

Operating Income Statement:
The operating income statement provides company management with information on the company's status quo on a permanent basis.

Control of Economic Efficiency:
Accounting facilitates the permanent control of economic efficiency and profitability of the operational processes.

Controlling Tasks:
Accounting provides the information required for making business decisions, such as investment decisions, budgeting, pricing, program policy, choice of the production method, make-or-buy decisions, etc..

The internal presentation gives a realistic view of the company's situation so that the correct decisions can be made.

1.3. Subsidiary Areas

The various different objectives necessitate a separation of accounting into external and internal income statement categories. Cost accounting is subdivided as follows:

- *Internal*: cost and performance accounting (internal income statement).
- *External*: balance of trade (external income statement), tax balance sheet (fiscal income statement).

With the aid of cost and performance accounting, also called factory accounting, all the costs incurred are identified and allocated to the cost centres and cost units which have caused them.

Financial accounting or administrative accounting depicts the company's asset and revenue situation.

Business statistics and budgeting are subsidiary functional divisions of accounting. By means of business statistics, operational figures are processed and converted into ratios, tables and graphic illustrations. Planning calculations, such as “investment analysis” and “budgeting” are designated for the attention of company management (Examples: How advantageous is a certain planned investment? Identification of the optimum order quantity, batch size, production program, choice of production method, etc.).

The internal and external income statements are the major components of cost accounting.

	Internal Accounting	**External Accounting**	
	Costing	**Balance of Trade**	**Tax Balance Sheet**
Type of Income:	Internal income or operating income.	External income or trading income or profit.	Fiscal income or taxable profit
Statement/Purpose:	States how the division has performed.	States the income which the company has obtained from transactions with its business environment	States which basis of valuation must be used for taxation.
Objective:	Assessment for intracompany purposes.	External statement.	Statement f.a.o. Inland Revenue.
Organisation:	Factory accounting, costing	Administrative accounting, financial accounting.	Tax consultant, administrative accounting, tax department.
Legal Obligation:	None (exception: public orders).	Commercial Code (Handelsgesetzbuch (HGB)), disclosure requirement (if applicable)	Income Tax Act, Internal Revenue Code.
Frequency of Execution:	Several times a year (e.g., monthly).	Annually.	Annually.
Planning Period:	1 year.	1 year.	1 year.
Tasks:	Calculation of the short-term operating income, decision tasks, controlling tasks.	Calculation of annual returns, asset and liabilities holdings, provision of data for dispositive purposes.	Calculation of the taxable profit.
Target Value and Calculation of Target Value:	Internal income = output – costs.	External income = revenue – expense.	Fiscal income: by comparing operating (working) assets, by comparing operating income and operating expense.

1.4. Basic Terms of the External Income Statement

As the external and internal income statements are prepared in consideration of different objectives it is necessary to use different terms for the purposes of distinguishing between the two types of statement. In the external income statement the following basic terms are in use:

- Outpayments / Deposits
- Expenditure (Outlay) / Income
- Expense / Revenue

	Definition in Brief	Dimensions
Outpayments	Disbursements of liquid funds per period	€/period
Deposits	Receipts of liquid funds per period	€/period
Expenditure (Outlay)	Monetary value of goods and services purchased	€/period
Income	Monetary value of goods and services sold	€/period
Expense	For the ascertainment of returns of periodically apportioned expenditure incurred over a period (= each decrease in equity, which is no capital repayment)	€/period
Revenue	For the ascertainment of returns of periodically apportioned income in a certain period (= each increase in equity which is no new capital inflow)	€/period

The following *Real World Example* illustrates the difference between payment, expenditure and expense:

In October, a company purchases 10dz of raw materials at 120€/dz. Payment is made in two installments of 600€ each in October and November. The raw materials are being processed in November (2dz), December (3dz) and January (5dz). What do outpayments, expenditure or expense, respectively amount to from October to January?

	Total:	**Year 01:**			**Year 02:**
		October	November	December	January
Outpayments (€/month)	1.200	600	600		
Expenditure (€/month)	1.200	1.200			
Expense (€/month)	1.200		240	360	600

This example emphasises the necessity of making a clear distinction between these terms in the external income statement. Outpayments and expenditure (or deposits and income, respectively) are not identical in cases where goods or services are not paid for in cash, i.e., if payment terms have been agreed or an advance payment has been made. There are several correlations between the terms “outpayments”, “expenditure (or outlay)“ and “expense“ which can be illustrated as follows. These correlations can be transferred to the terms “deposits”, “income” and “revenues” in analogy:

	Example
Outpayments which are **no** expenditure:	Withdrawal of profits by the entrepreneur (cash payout), loan capital redemption
Deposits which are **no** income:	Deposits made by the entrepreneur to increase the capital share, capital borrowing
Outpayments which are **also** expenditure:	Cash purchase of raw materials
Deposits which are **also** income:	Cash sale of products
Expenditure which is **no** outpayment:	Credit purchase of goods
Income which is **no** deposit:	Credit sale of goods
Expenditure which is **no** expense:	Purchase of raw materials and consumption in a later period
Income which is **no** revenue:	Down-payments received
Expenditure which is **also** expense:	Purchase of raw materials and consumption in the same period
Income which is **also** revenue:	Sale of finished goods which were produced in the (same) period
Expense which is **no** expenditure:	Depreciations of previously purchased machinery or material consumption from stock inventories
Revenue which is **no** income:	Stock production of goods or intra-plant service output (company-constructed fixed assets)

By comparing revenue and expense, the company's overall income can be calculated. Part of the income is obtained in the pursuit of the business objective, the other portion is gained from transactions unrelated to the regular business use. For this reason, the company's income must be subdivided into its operational and non-operational components. A further subdivision of the total income (= profit) into ordinary (regular) and extraordinary (irregular) income also makes sense. This results in the following structure:

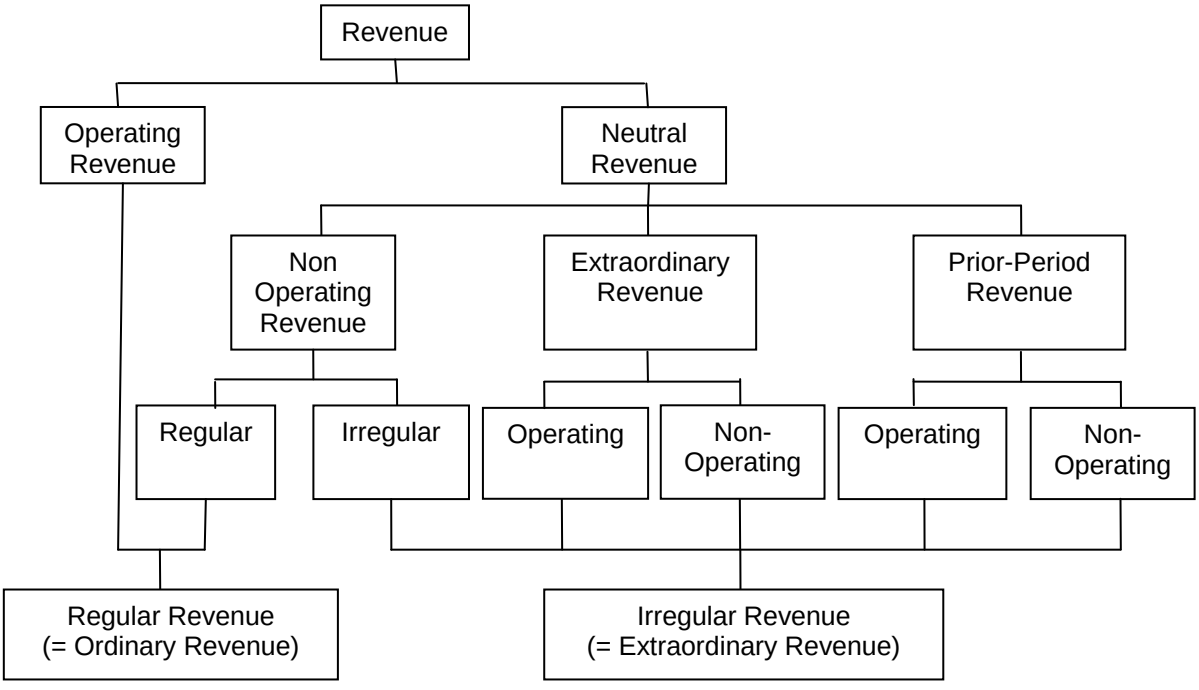


fig: Revenue structure (in analogy: Expenditure structure)

Operating Revenue is revenue which a company obtains on a regular basis in the pursuit of its regular business activity and objectives. (Example: the number of cars produced and sold by an automobile manufacturing plant within a certain period).

Neutral Revenue comprises non-operating (or outside), extraordinary and prior-period revenue.

Examples: *Non-Operating Revenue* is regular revenue obtained from shareholdings in other companies (= financial income) or irregular revenue from the sale of properties not in operational use.

Extraordinary Revenue is either operating or non-operating revenue and cannot be allocated to the ordinary operating result as it is irregular: e.g., revenue gained from the sale of a machine which has been replaced by a cheaper one.

Prior-Period Revenue is all operating or non-operating revenue pertaining to past accounting periods and not to the current one, such as trade tax refunds.

Operational Expense is regular expense incurred in the context of the business use (Examples: raw materials expense incurred by an industrial enterprise or salaries for sales personnel incurred by a commercial business).

In analogy to revenue, **Neutral Expense** is subdivided into non-operating, extraordinary and prior-period expense.

Examples: *Non-Operating Expense* is not incurred in the pursuit of the regular business activity, e.g., regular contributions for the company's own kindergarten and irregular tax-deductible donations.

Extraordinary Expense occurs outside the company's regular business activity. Operating or non-operating expenses which are incurred very rarely or expenses of an unusual amount count towards irregular expenses, e.g., extraordinary expenses incurred for the shut-down or restructuring of parts of the plant, expenses for damages incurred due to fraud or embezzlement, expenses for unusual employee compensations, expenses for unusually high damage claims.

Prior-Period Expense is not incurred during the current accounting period but must be recorded during this period notwithstanding, e.g., back payments on trade tax, expenses for the repair of previous damage for which no accrual arrangements have been made, expenses for damages which are not covered by existing accruals.

The aforementioned structure also applies to the external total income. However, the details are not particularly important in this context, but rather the different options of interpreting the terms with regards to the different income statements. Income (=profit) is an ambiguous term. Its precise meaning is only revealed when we know which type of income statement it refers to. Therefore, the following definitions have been created:

- In costing, the operating income is the differential amount between output and costs.
- In the profit and loss account, the company's income is calculated by deducting expense from revenue.
- The fiscal income statement defines the fiscal income as follows: operating income minus operating expenses or, in other words: fiscal income = operating (working) assets of the current year – operating (working) assets of the previous year (+ withdrawals – deposits).

1.5. Basic Terms of the Internal Income Statement

The differential amount between operational output and costs describes the company's internal income and results gained exclusively from the actual **Business Use**. The following definitions of the separate variables will help you gain a better understanding of the internal income statement.

1.5.1. Costs

Costs are the monetary value of goods consumed during the production process for the production and sale of operational output and the maintenance of capacities which are required for the process. Costs are characterised by the following criteria:

- Material goods and/or services must be consumed
- The consumption of material goods and/or services are to be assessed
- Consumption must take place as part of the operational production process
- Consumption must be performance-related.

By carrying out a comparison of *Costs and Expense,* both their common traits and differences become clear.

Neutral Expense is an expense which is not contingent on the ordinary (= regular) operational service output process and does therefore not attract any costs. Neutral expense is categorised by:

- Non-operating expense (Example: depreciations on shareholdings)
- Extraordinary expense (Example: loss incurred in the sale of plant and equipment
- Prior-period expense (Example: back payments on tax from previous years).

An expense incurred in the course of the business use is called *Purpose Expense.* In costing, it is recorded either as it is under basic costs or at an adjusted value under "Other Costs" (Example for purpose expenses which are also basic costs: energy and insurance expenses).

Other Costs are costs that differ from expenses in value. Example: the amount of implicit interest charges may differ from the interest actually due as in costing, equity capital is interest-bearing. Implicit interest charges on equity may, for example, also be *Extra Costs* if equity is regarded as a separate entity and not as part of the total capital. The actually encountered risks differ from absorbed imputed risk costs.

Extra costs and other costs are also imputed costs. They are not connected to any expenses and no expense will be incurred through them. Extra costs and other costs are opportunity costs by their nature; i.e., they indicate a foregone use. By looking at these costs, costing in different companies can be compared. Examples: imputed proprietor's income for the owner-operator's labour efficiency. The entrepreneur renounces income obtained from other work activities. Imputed rent for rooms owned by the entrepreneur. The entrepreneur waives rent income from third parties.

Delimitation	**Definition**	**Example**
Expenses which are no costs (neutral expense)	Consumption of goods and services which are not necessary for operations and are not connected with costs.	
Non-operating expense		Depreciations on financial investments
Extraordinary expense		Sale of a plant below book value
Prior-period expense		Back payments on tax
Costs which are also expenses (basic costs = purpose expenses)	Operational consumption of goods and services which are connected with expenses of the same value.	Utilisation of goods, energy cost, insurance policies
Costs that differ from expenses in value (other costs)	Operational consumption of goods and services, which are valued differently in the internal and external income statements.	Imputed depreciation allowance, imputed risk premium, implicit interest charge
Costs which are no expenses (extra costs)	Operational consumption of goods and services not connected with expenses.	Imputed proprietor's income, imputed rent

1.5.2. Service Output

A company's output is generally regarded as the counterpart to the costs incurred. Service output is the monetary value of goods and services during an accounting period (= output in terms of value), which result from the operational production process. The term “revenue” is used in this context. Service output is hardly ever regarded as the quantitative output generated by a company (= number of units produced, tons of material extracted, etc.). We shall not go into the correlations between service output in terms of value (=revenue) and quantity at this point.

In economic terms, output is characterised by the following criteria:

- Material goods and/or services must be produced,
- Service output is to be valued in monetary terms,
- Production is operational.

As operational service output is ultimately cost-bearing, it is also referred to as a cost unit, whereby a distinction is made between market performance and intra-plant service output. The total of both these performance areas makes up the total operating performance (total output).

Market Performance comprises all sales revenues for products, services, merchandise, and also all increases in inventories of finished and semi-finished products. *Intra-Plant Service Output* includes all capitalised own assets within the company, such as company-produced machinery and tools.

The terms “output“ and “revenue“ and “expense“ and “costs“ must be carefully distinguished.

Neutral Revenue is revenue which does not result from the company's ordinary (= regular) business activities. It has no cost characteristic. For this reason, neutral revenue may not be included in the internal income statement (= costing). Neutral revenue is subdivided into

- Non-operating revenue (Example: interest from financial investments)
- Extraordinary revenue (Example: profit yield from the sale of plant equipment above book value)
- Prior-period revenue (Example: tax refunds)

Revenue gained in the process of the business use is called *Operating Revenue (Operating Income)*. In costing, this income is recorded either as it is under basic service output or at an adjusted value under “Other Service Output“. (Example: Basic service output are intra-company sales).

Other Service Output is service output which differs from revenue in value. In the context of the external income statement (= profit and loss account) surplus inventories of semi-finished and finished goods as well as company-produced machinery and tools must be regarded in relation with the expenses pertaining to them. The internal income statement (= costing) values surplus inventories of semi-finished and finished goods as well as company-produced machinery and tools in relation with the costs pertaining to them.

Comment: In the context of balance sheet valuation, assets may be carried at historical cost or factory cost only. However, in the context of costing, the inventory may be valuated at full cost, direct cost, replacement cost, market prices or at the target revenue value.

Additional service output and other service output are part of imputed service output. They are not connected with any revenue and no income will be obtained through them. They can serve to compare costing in different companies. Example: additional service output is service output from the voluntary disposition of material goods, services and/or energy input; i.e., no revenue is obtained. Additional service output may also comprise company-created patents which have not been marketed yet (= hidden reserves).

Delimitation	**Definition**	**Example**
Revenue which is no service output (neutral revenue)	Increasing income by transactions which are not conditional upon operations.	
Non-operating revenue		Revenue from capital which is not necessary for company operations
Extraordinary revenue		Sale of plant equipment above book
Prior-period revenue		Tax refunds
Service output which is also revenue (basic service output = operating revenue)	The same increase in income in both the internal and external income statement resulting from operations.	Revenue gained from operational activities (sale of goods, services and finished goods)
Service output which differs from revenue in value (other service output)	An increase in income resulting from operations which is reported differently in the internal and external income statements.	Surplus inventories of semi-finished and finished goods as well as company-constructed fixed assets and tools which are valued at costs.
Service output which is no revenue (additional service output)	Increase in income in the internal income statement which is not connected with revenue.	Voluntarily disposition of finished goods or services

1.6. Correlations between the Internal and External Income Statements

The external and internal income statements are correlated via the following aspects:

- Common basic terms: the basic terms used in financial accounting and in costing describe different facts; however, they are closely interrelated. *Inventory Variables* (such as cash balance = cash holdings and sight deposits; net financial assets = cash balance + accounts receivable - liabilities; net assets = net financial assets + tangible assets; necessary operating assets = net assets – assets not necessary for operations) are changed by *Flow Variables* (such as outpayments/deposits, expenditure/income, expense/revenue and costs/output) in the process.
- Data streams: On the one hand, there is a mutual exchange of *Information* between the external and internal income statements, on the other hand, both income statements receive the same information from other departments. (e.g., payslips) or supply other departments with information (e.g., business statistics).
- Organisation of accounting: the external and internal income statements can be prepared *together or separate*ly. A system which looks at each income statement separately is referred to as “dual accounting system“. If the accountant contemplates both income statements within one organisational framework, this is called a “one-circuit system“. In the traditional one-circuit system the internal and external income statements are prepared within one accounting circuit. The distinction between costs and output on the one hand, and expense and revenue on the other is carried out in the category of non-operating expenses and revenue. The modern dual accounting system treats the internal and external income statements separately. Either calculations are executed in separate accounting circuits whereby costs and output are developed from expense and revenue items within the context of accrual basis accounting.

2. FUNDAMENTALS OF COST AND PERFORMANCE ACCOUNTING

2.1. Introduction (Reasons for Introducing this Method)

For both internal and external reasons, all industrial, trading and service companies prepare an explicit cost and performance account.

External reasons may comprise:

- Companies are forced to reassess their level of costs as competition within the industrial sector is ever-increasing due to the opening of EU markets.
- An effective expansion of the range of products (for the purpose of making the product more distinct) requires careful planning on the basis of cost and performance accounting.
- Increasingly shorter product life cycles and rapidly changing overall economic framework conditions lead to a rise in development costs. A well-considered production process results in the obtainment of the necessary profit.
- A high level of product availability, readiness to deliver and high quality products effectively increase logistics and quality costs. (e.g., just-in-time-production in the automobile industry).

Internal reasons:

- Dissatisfaction with previous calculations.
- Introduction of cost planning (budgeting) and an improved control of economic efficiency.
- Introduction of a controlling system (= system for target-oriented planning, controlling and managing of and information supply to the company and its subsidiary divisions.).
- Introduction of profit centres: profit centres are company divisions which are autonomous to a certain degree. They are structured by business area (e.g., products, customer group or sales regions) and not by operational function.

The outward-view presented in the profit and loss account and on the balance sheet does not allow for an optimum management of the company as this information is not suited for internal control processes. Furthermore, these calculations are carried out only once a year and figures become available only after decisions have already been made. The company ought to install a modern, up-to-date cost and performance accounting system to guarantee an appropriate control of operational performances. Cost and performance accounting is part of corporate planning.

2.2. Tasks of Cost and Performance Accounting

Companies have both short-term and long-term objectives. The short-term single objectives include the obtainment of a higher net profit margin or an increase of profits. Long-term objectives include the intention of creating a profit and the generation of economic output. Cost and performance accounting provides the information required to ascertain whether or not the set objectives can be achieved.

The tasks of costing are to provide information on costs and performances for:

- the calculation of the operating result
- controlling tasks
- decision tasks (controlling tasks)
- valuation tasks.

These tasks will be explained in detail in the following chapters.

2.2.1. Operating Income Statement

The operating income statement is a periodical calculation of the company's internal performance so that the company is always up-to-date with the level of achievement of the aforementioned set goals. Short-term achievements are categorised by product, customers, sales regions, etc., in order to be able to assess how individual cost units have performed (the operating income statement shall be discussed more elaborately in Chapters 4 and 7.).

2.2.2. Controlling Tasks

The tasks of controlling comprise the monitoring of the short-term income, cost types, cost centres and cost units. With the help of these controlling processes, company management is in a position to recognize and, if applicable, rectify shortcomings. The main emphasis in the control of economic efficiency is on functional divisions (= cost centres), as this is the only method of detecting cost cutting potentials. Cost cutting potentials are revealed by comparing

- the costs incurred in a certain period with the costs incurred in another period (= time comparison),
- the costs incurred by one's own company with the costs incurred by another company (= intercompany comparison),
- planned costs with actual costs (= target/actual comparison).

Another way of reducing costs is to carry out a so-called ABC-Analysis (= Which raw materials, auxiliaries and supplies belong to group A, the group incurring the highest storage costs?) and to prepare a top ten list (= in which areas are personnel costs particularly high?).

2.2.3. Decision Tasks

Costing is a method of determining prime cost and price limits. Furthermore, costing is a tool which supports company management in the preparation, making and monitoring of short-term decisions. For medium-term and long-term decisions other tools are required, such as the *Step-by-Step Analysis of Fixed-Cost Allocation* (= method for the optimisation of programs which splits fixed costs into various layers and allocates them to certain reference figures according to the principle of causation, e.g., fixed product costs), *Activity-Based Costing (ABC)* (= costing method which looks at company operations as a sequence of activities and allocates overheads to activities across various cost centres) and *Dynamic Capital Expenditure Account Methods* (= payments made at certain points in time are adjusted by adding unaccrued interest or by discounting their value to make them mathematically comparable).

The following illustration shows various functional divisions in which costing supports the decision-making process:

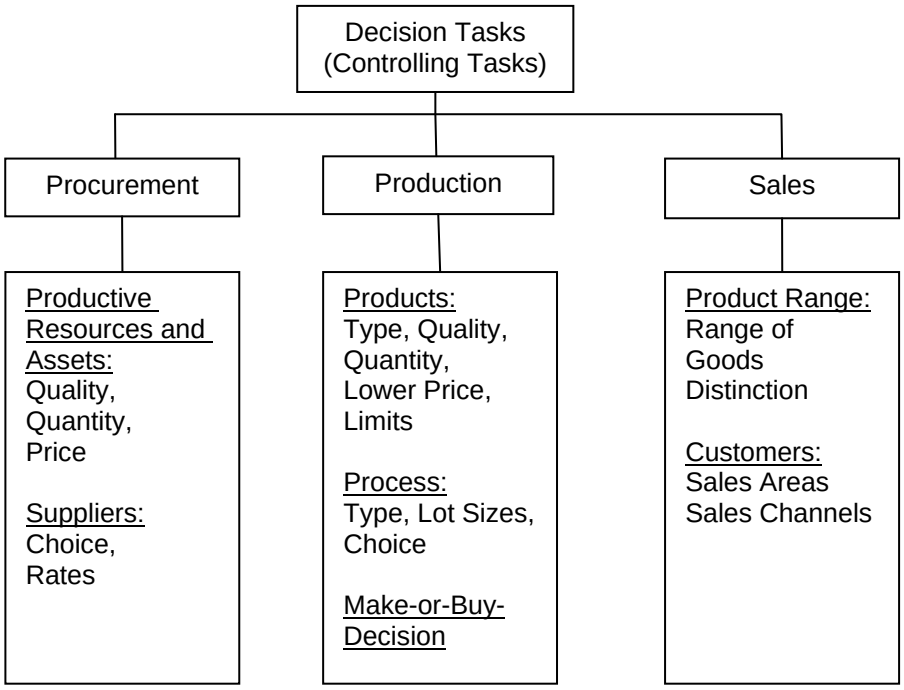


fig: Costing-based decisions.

2.2.4. Valuation Tasks

Company-constructed fixed assets, semi-finished and finished goods must be valued in the context of preparing the internal and external income statements. Valuation at the sales price does not make sense and is not permitted in the external income statement in compliance with the *Imparity Rule* (= principle according to which possible future losses must be treated differently from profits). Any anticipated losses which have not yet been realised must be reported. The *Realisation Principle,* on the other hand, says that any anticipated profits which have not been realised must not be reported, as this would mean that profits which will only be obtained in the future are being reported today. Therefore, company-constructed fixed assets and inventories are valued at the costs (in costing) or, respectively, expenses (in the balance of trade and on the tax balance sheet) that have been incurred for them.

2.3. Cost and Performance Accounting Requirements

Costing must be quick, flexible and integrative so that it can fulfil the aforementioned tasks. The main demands on costing are:

- Quickness (more important than accuracy)
- Flexibility (calculation of the prime cost of products, exercising control over economic efficiency, enabling additional calculations)
- Integration (linking technical and economic controlling)

The results gained from cost and performance accounting must be made available at short notice so that the necessary conclusions can be drawn and entrepreneurial decisions can be made.

The task of cost and performance accounting is not only to provide information for the purpose of determining the prime cost of products and controlling economic efficiency, it must furthermore supply information on customer-related, sales area-related and investment-related (etc.) costs and performances.

As computers are increasingly integrated into all business areas, information systems working in parallel are linked more and more often, resolving the former strict separation of competencies according to department, such as research and development, production, administration, etc.. The possibilities arising from computer-aided work processes within the company shall not be discussed any further at this point.

2.4. Cost and Performance Accounting Structure

In a first step, cost and performance accounting comprises the calculation of short-term results according to the expenditure style of presentation which is based on cost type and performance type accounting. This, in turn, is based on the actual data retrieved from administrative accounting. However, a company can be managed merely insufficiently by means of this type of cost and performance accounting as it is rather a basic system which does not allow for an allocation of costs to cost units. Controlling is also limited as costs cannot be allocated to functional areas (= cost centres). In order to fulfil these tasks notwithstanding, standard cost type accounting must be extended by a cost centre and unit-of-output costing statement in a second step.

Cost Type Accounting is the point of departure in costing, followed by the recording and structuring of costs per accounting period. Cost types are categorised by direct costs and overheads. In modern costing, cost types are allocated not only to products or services but also to other cost units, such as the channels of distribution or customers. Consequently, a separate calculation must be carried out for each cost unit in order to allocate direct costs and overheads, fixed costs and variable costs accordingly. Very often fixed costs and variable costs can only be successfully separated in cost centre accounting. As a result, expectations on the recording and processing of costs in cost type accounting are pitched higher and higher.

Cost type accounting is followed by *Cost Centre Accounting*. In the course of this calculation, any costs which cannot be directly allocated to cost units (overheads relating to cost units) are initially assigned to the company divisions where they were incurred. Afterwards, cost units are charged with overheads according to the extent to which they have utilised the service output generated by the cost centres. Cost centre accounting improves the accuracy of the calculations. Furthermore, overheads can only be controlled properly in the relevant cost centres.

The third element of costing is the *Unit-Of-Output Costing Statement.* Its task is to calculate the costs per cost unit product, service, customer, channels of distribution, sales areas, investment, etc.). A distinction is made between unit-of-output costing period statement (unit-of-output costing statement for the total number of units of a certain output type produced over a period) and cost unit accounting unit-of-output costing statement for a single service unit). In reality, cost unit accounting is normally regarded as a calculation. Its task is to assess the earning power of a cost unit by comparing sales revenues and charged costs. It also identifies the short-term and long-term lowest-price limit of the operational service output. Furthermore, the unit-of-output costing statement serves the purpose of valuing semi-finished and finished goods and provides the necessary information for operational decisions (= production program, choice of production method, make-or-buy decision).

An informative and meaningful costing system comprises cost type accounting, cost centre accounting and unit-of-output costing statement. Should the company also require some information for short-term decisions, costing must take the form of *Direct Costing* (= contribution (margin) costing). However, an effective control of the company's economic efficiency is only possible by means of extending costing to the standard costing method (budget accounting).

	Traditional	**Modern**
Cost type accounting	Recording and structuring of costs, in order to	
	transfer them to products or services (by means of cost centre accounting).	furthermore, charge them to other cost units.
Cost centre accounting	Charging of overheads to functional areas (divisions) in order to	
	allocate them to products or services in a differentiated way.	make the intra-plant service output processes comprehensible.
Unit-of-output costing statement	Calculation of costs and income relating to a cost unit	
	product, service	product, service and/or sales area and/or channels of distribution and/or customer, etc.

Please refer to Chapters 3, 5 and 6 for a comprehensive illustration of the core components of costing.

2.5. Cost and Revenue

As already mentioned in Chapter 1, **Costs** are the monetary value of goods consumed during the production process for the production and sale of operational output and the maintenance of capacities which are required for the process.

Costs comprise two components:

- fixed costs
- variable costs

Fixed Costs do not change in proportion to the volume of output and result from the provision of a certain capacity. Therefore, fixed costs are often referred to as standby costs. Examples: rent and lease, consultation fees, insurance costs, lighting costs, building security costs, personnel costs (partially), etc..

Variable Costs do change in proportion to the volume of output. They increase when the volume of production increases and they decrease when the volume of production is reduced; i.e., direct labour costs, costs of raw materials, auxiliaries and supplies and charges for freight.

Costs can be broken down into their fixed and variable components by applying various methods. The freehand method (= scatter chart) is based on observations of former actual costs and the value appendent to their relevant reference figure.

Example: The development of the cost of repairs in relation to the volume of output within a production department.

It is of great importance to a company to know which factors influence cost levels and how these factors change. Therefore, some essential cost specification factors are distinguished:

- Employment (machine operating hours, working hours, volume of output)
- Prices of the productive resources and assets
- Quality of the productive resources and assets
- Scale of the enterprise (capacity)
- Production methods

Revenues are the proceeds from the sale of material goods and services. They are calculated by multiplying the sales volume X with the unit price P. The equation is thus:

Revenue = P * X

The terms “revenue” and “sales” are synonymous but should be used alternatively and not additionally.

To a company, knowing the cost specification factors is as important as knowing which factors condition the sales volume and how these factors exert influence. The following sales specification factors can be identified:

- Sales volume
- Sales price
- Quality of the products
- Customer preferences

2.5.1. Cost and Revenue Functions

Cost functions state the extent to which total costs (TC) are dependent on the volume of output (number of units) (X). The underlying assumption here is that other cost specification factors remain constant. By applying the terms “fixed costs“ and “variable costs“ a cost function for a cost sub-centre or cost centre may be identified, however not for the company in its entirety.

By means of a *Cost Function* - e.g., total costs (TC) = fixed costs + variable costs (dependent on the volume of output X) - or by examining known cost points, a cost progress chart (= pattern of cost behaviour dependent on the volume of output) can be prepared. In reality, the determination of a company's cost function is hardly ever accurate as this function is known for a few alternative number of units only. Therefore, the pattern of cost behaviour for the corresponding production area is merely an approximation.

However, an assessment of the company's total costs is not satisfactory as overall costs are composed of a variety of cost types. All in all, the following variables must be examined in order to be able to draw conclusions relating to patterns of cost behaviour:

Term	Symbol	Definition	Dimension
Total costs	TC	Total costs incurred by a company for the production of the operational service output over a period.	€/period
Variable costs	VC	Costs which increase when production levels increase and which decrease when production levels decrease.	€/period
Fixed costs	FC	Standby costs which remain constant when the volume of output changes.	€/period
Costs per unit (average unit costs)	unit AC	unit AC = total costs / volume of output = K / X	€/unit
Variable costs per unit	unit VC	unit VC = variable costs / volume of output = VC / X	€/unit
Fixed costs per unit	unit FC	unit FC = fixed costs / volume of output = FC / X	€/unit

Another important factor in the context of modern costing is *Marginal Cost* (MC). Marginal costs comprise any additional costs incurred when raising the volume of output or, respectively, the costs saved when reducing the volume of output by one unit. Mathematically, the marginal cost function is expressed as the 1st derivative of the total cost function.

Marginal Cost:

MC = dTC/ dX

If the total cost function is unknown, an approximation of marginal cost can be determined by means of a differential value calculation. The costs of two volumes of output which are fairly close together are calculated, and the difference in costs ($TC_2 – TC_1$) is divided by the change (difference) in the volume of output ($X_2 – X_1$). The result is the average marginal cost for a particular section of the volume of output.

Average Marginal Cost:

$$\mathbf{MC = (TC_2 – TC_1) / (X_2 – X_1)}$$

Sales (or Turnover) is usually depicted in relation to the sales volume. The underlying assumption here is that other sales specification factors remain constant. The pattern of sales behaviour is largely dependent on the market system where the company offers its products. Therefore we distinguish:

- Sales (turnover) functions in a market polypoly
- Sales (turnover) functions in a market monopoly

In a polypoly (large number of buyers and sellers), an individual seller cannot influence the market price. He must accept the market price as given. An increase in the number of goods offered by a seller does not result in a drop in the market price; neither does a minimum number of goods offered result in an increase of the market price. A change in the volume of goods on offer has no influence on the market price within a polypoly.

In a polypoly, the sales function can be specified by multiplying the sales volume with the relevant price. The equation is:

Sales Function:

$$\mathbf{S_1 = X_1 * P_1}$$

As prices are constant in a polypoly the sales function is a linear function.

In a monopoly (one seller) the seller can determine the price by himself. However, he will have to face the reactions to the price he has set. The price-sales function determines the relations between the asking price and the marketable quantity of a definite product. The behaviour of such a function can only be estimated. In reality, only a few components of this function are known, such as the current price, the current sales volume as well as the corresponding values of previous months. The components pertaining to the current price-quantity combination are particularly important and of practical relevance. In the simplest case scenario, the price-sales function is straight-line. Hereby, P_h states the price at which the demand equals zero. Each price reduction by ΔP leads to an increase in demand by ΔX. At a price of zero € a limited volume, the volume of saturation X_s is in demand.

The aforementioned prerequisites also apply to an oligopoly, a market system with very few big sellers. In addition to anticipating how buyers might react, a company should also consider possible reactions by competing companies. In any case, the sales function is parabolic.

To illustrate the *Sales Curve* either the sales function or individual sales points must be known. In reality, the determination of a company's sales function is hardly ever accurate as this function is known for a few alternative volumes of output only. Therefore, the pattern of sales behaviour for the corresponding production area is merely an approximation.

In addition to marginal costs, *Marginal Sales* also represent an important variable in the context of modern cost and performance accounting. Marginal sales (S') are defined as being the increase (decrease) in sales in proportion to an increase (decrease) in the volume of output by one unit. Mathematically, the marginal sales function is expressed as the 1st derivative of the sales function:

Marginal Sales:

$$S' = dS / dX$$

In analogy to marginal costs, an approximation of marginal sales can be determined in case the sales function is unknown:

Average Marginal Sales:

$$S' = (S'_2 - S'_1) / (X_2 - X_1)$$

The point of intersection of the cost and sales function, where profits equal zero is called *Profit Threshold* (= Break-Even Load) or "Break-Even Point".

The *Profit Limit* (=Utility Limit) is the point beyond which the profitable basis is abandoned. The sales and cost functions intersect for a second time.

2.5.2. Patterns of Cost Behaviour in Practice

In practice, the patterns of cost behaviour depend on the production conditions under which the service output is generated. As early as in the 19th century, Heinrich von Thünen carried out an empirical study of production conditions in agriculture. He furnished proof that an increase in the productive resources applied (e.g., fertiliser) results in the obtainment of revenue, provided that all other factors remain constant. Initially, revenue increases overproportionally (= progressively), then increases less than proportionally (= degressively) and finally decreases. This causality is referred to as the "*Law of Diminishing Returns*". In those days, the s-shaped pattern of cost behaviour was derived from these observations.

Today, production conditions such as in agriculture, where revenue reamins unchanged even when one productive resource is replaced by another is called Type A production function.

In Business Administration, the science which developed at the beginning of the 20th century, the presumption was made that the s-shaped patterns of cost behaviour also apply to industrial production processes. However, very early on empirical studies showed that the patterns of cost behaviour in many industrial enterprises tend to be linear. In the 1950s, E. Gutenberg lay the theoretical foundation for these observations by developing a Type B production function. He realised that in the industry the input ratio of the productive resources and assets usually is predetermined and non-changeable. Therefore, there is a fixed ratio between the factors labour and machinery and consequently, one factor limits one or more other factors. From these conclusions, the linear cost function was derived and developed as the standard industrial production process.

2.5.3. Break-Even-Analysis

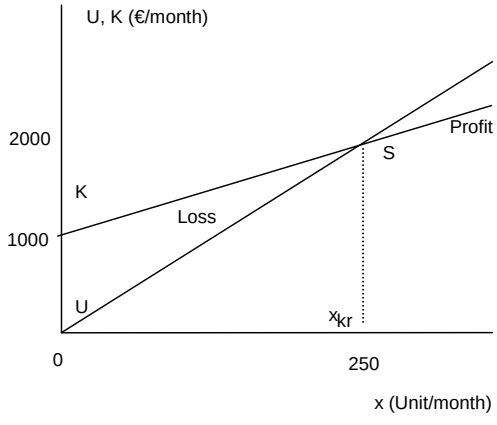
The calculation of the sales volume, which results in neither a profit being gained nor a loss being incurred (= Profit Threshold) is called Break-Even-Analysis. The sales volume where profits equal zero is called "*Critical Volume*". Mathematically, this volume is calculated by equating sales and costs or by setting profits to zero, respectively. Graphically, the profit threshold is at the point of intersection of the sales and cost functions. This point is also called "*Break-Even-Point*" or point of coverage. The Break-Even-Analysis is also applied in the context of investment analysis where it is referred to as "Critical Value Calculation".

The following *Example* demonstrates the *Various Break-Even-Analysis Methods*:

A company produces a good which is sold at €/unit. Variable Costs amount to 4 €, monthly fixed costs amount to 1000 €.

1. Setting Sales = Costs

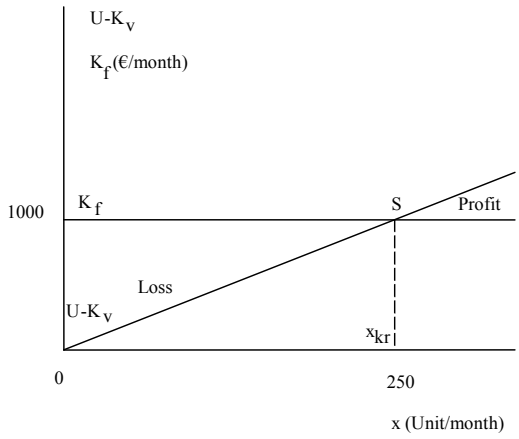
8X = 1000 + 4X
4X = 1000
X = 250 (unit/month)



At a monthly sales volume of 250 units the total costs (TC) are covered by sales (S). Graphically, the critical sales volume is identified by constructing a perpendicular from the break-even point to the horizontal axis of coordinates.

2. Setting the Contribution Margin (Gross Profits) = Fixed Costs

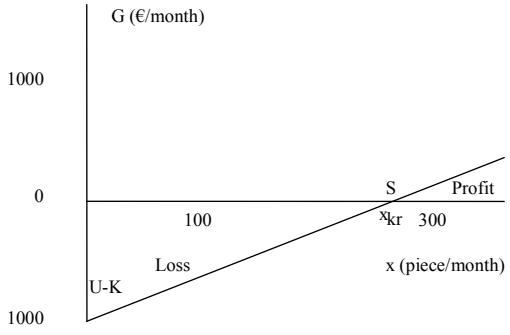
S – VC = FC
8X – 4X = 1000
4X = 1000
X = 250 (unit/month)



At a monthly sales volume of 250 units the accrued contribution margins (= gross profits) are equal to fixed costs. The contribution margin of each additional sales unit increases net profits.

3. Setting Profits = 0

PX – FC – unit VCX = 0
PX – unit VCX = FC
X = FC / P - unit VC
X = 1000 / 4
X = 250 (unit/month)



The *Profitable Basis;* i.e., the zone in which revenues > costs starts at 250 units per month.

The Red; i.e., the zone in which revenues < costs starts at less than 250 units per month.

8. TEST QUESTIONS AND ANSWERS

1. What is "cost account" ("internal accounting")?	Cost accounting is the calculatory recording, processing and controlling of all the data describing company operations in terms of quantity and value. Each transaction is substantiated by a document, processed by means of further calculations and and assessed.
2. What are the tasks of cost accounting?	Outward view (external presentation): documentation, reporting and taxation basis. Inward view (internal presentation): operating income statement, control of economic efficiency and controlling tasks.
3. Which subsidiary areas does cost accounting comprise?	Internal income statement (costing) and external income statement (balance of trade and tax balance sheet).
4. Explain the tasks of financial accounting and the tasks of costing (each separately)!	Tasks of financial accounting: calculation of annual returns (profit and loss account), calculation of asset and liability holdings (balance sheet) and provision of data for dispositive purposes. Tasks of costing: short-term income statement, control of economic efficiency, provision of data für dispositive purposes (controlling), decision tasks, controlling tasks and provision of data for inventory valuation.
5, What is described by a cost function?	The cost function illustrates the volume of output and cost relation. Hereby, the cost function states the minimum costs incurred for different volumes of output.

6, Do fixed costs influence the value of marginal costs?	Marginal costs are defined as changes in costs in case of changes in the operating rate. As fixed costs remain constant even when employment levels change, they have no impact on marginal costs.
7. What is the significance of determining marginal costs in practice?	Marginal costs form the basis of short-term business decisions.
8. What are the tasks of costing?	Short-term ascertainment of returns, control of economic efficiency, calculation, provision of data for dispositive purposes, provision of data for the valuation of semi-finished and finished goods as well as company-constructed fixed assets.
9. What is the contribution margin of a product?	The contribution margin of a product states the the amount which a product contributes to cover the company's fixed costs and, once these are covered, the amount it contributes to the realisation of profits.
10. Outline the most important differences between absorption costing and direct costing!	Breakdown of costs in fixed and variable components in direct costing, Correct decisions on the production program in direct costing, Different operating income in case of changes in inventories.
11. Which fundamentals must be considered in cost type accounting?	Principle of purity (clean cost types). Principle of uniformity (uniform personal and periodical allocation of costs).
12. What are wages and in what way do they differ from salaries?	A wage is the financial consideration for a certain work performance regulated by contract. Salaries are not directly based on performance.