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Key Performance Indicators for Sustainable Management

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A Compendium Based on the “Balanced Scorecard Approach”

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Dedicated to:

My Parents
Ursula and Konrad Krause
With special gratitude for their love and care
– Hans-Ulrich Krause

My Parents
Subhadra and Ratan Lal Arora
For their unforgettable role in my life
– Dayanand Arora

Preface

It is a matter of delight for us to present the first edition of our book "Key Performance Indicators for Sustainable Management". Our main purpose in writing this book is to organize and present major key performance indicators within the framework of the balanced scorecard approach. The book offers many thoughtful insights into the sustainable management of business operations in the modern world. We consider the book a valuable companion for business practitioners, students and teachers alike. We believe that even the reader with little or no knowledge of accounting and finance can benefit from this book.

The four perspectives (financial, customer, process, and learning/innovation) of the balanced scorecard can be viewed as interdependent and hierarchical. We believe that constant learning and innovation, at the firm level, leads to the refinement of internal processes, and helps in improving operational efficiency. This results in increased customer satisfaction and higher financial performance. We selected 180 ratios, and consider these to be a representative collection of key performance indicators, supporting all four perspectives of the balanced scorecard. With a compact and consistent profiling of all ratios, and supporting ideas for calculating and interpreting the key performance indicators, the book takes on the character of a reference manual.

The book also provides cutting-edge knowledge on several ***key ecological indicators*** linked to the four perspectives of the balanced scorecard approach. Among others, these include resource efficiency, carbon footprints, product related recyclability, emission volume of production related pollutants and awareness about energy sourcing. The ecological indicators seek to encourage an attitude of "long-term" strategic thinking in business decisions. In addition to this, we have introduced several key indicators for ***"risk-related consciousness"*** in evaluating business performance. We think that managers need to be continuously aware of indicators, such as value at risk, cash flow at risk, bankruptcy risk, expected process based risks, and the cost effectiveness of risk management initiatives.

In order to facilitate the implementation of the KPI project in a business, we propose the use of 28 SMART (Specific, Measurable, Achievable, Relevant and Timely) key performance indicators. The SMART indicators in this book are marked with the symbol (S) and offer at a glance a good overview of the major indicators for all kinds of business organization, and particularly for small and medium-sized enterprises.

We would like to place on record our gratitude to Dr Stefan Giesen, our publishing editor at De Gruyter for his encouraging ideas and support in the timely completion of this project. We are also thankful to David Peck for his hard work in the language editing of the text. Needless to say, any remaining mistakes in language

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or content are still our responsibility, and we invite you to make suggestions to improve the next edition of the book.

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Introduction

The subject area of business administration can well be considered an applied science. It comprises three typical activities: Describing (for example, a problem or an activity), Explaining (for example, its context and/or its parameters) and Managing (for example, developing, implementing and/or monitoring) a chosen solution. In order to accomplish these activities, a comprehensive range of tools and instruments have been developed over time. Key Performance Indicators (KPIs) are an important example of such instruments.

Though the usage of key performance indicators has a long tradition, its practical application has always been coupled with innovative ideas and the need for improvement. They represent the outcome of a continuous process of change, derived through various mutations in the economic, technical, social, political and ecological environment. Therefore, business firms of all sizes regularly call for effective tools to successfully plan, manoeuvre, and control their business operations.

Over the last few decades, systems with pyramid-like structured financial performance indicators have been dominant (for example, the DuPont System). Now, new approaches, such as the balance scorecard, are gaining ground. A performance evaluation system based on balance scorecard emphasizes the importance of using all types of information, both financial and non-financial, which is essential to remaining competitive. The accounting reports of a firm's performance are now often based on critical success factors in four different dimensions: the first dimension of financial information is usually supplemented with three non-financial dimensions (customers, business processes, and human resource/innovation). The management (including reporting) of non-financial issues and activities is increasingly becoming a proxy (through an analysis of cause-effect relationships) for evaluating the overall performance and abilities of a firm. Thus, balanced scorecard provides a basis for a more complete analysis than is possible with financial data alone. In this context, we proudly place on record the fact that our book is based on the balance scorecard approach, and is probably the first one of its kind.

An interesting trend in the business world is the decentralization of responsibility and authority. This has led to a sizable increase in the number of executives who not only have to understand key performance indicators, but also systematically influence them. Such professional requirements are expected, not only from the managers trained in business administration, but also from engineers, scientists, legal professionals, and others, who have, over time, risen to senior management positions in their firms. In addition, the increased internationalization of firms, with globally aligned sourcing, production and sales networks, makes the use of English in business communication indispensable. This is equally true for both internal and external reporting. We believe this book will be a useful reference guide, kept on the shelf of professionals, and used in their professional training.

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In the academic world it is noticeable that students are increasingly expected to develop a sound understanding of modern management tools, including key performance indicators. This book provides both a basic as well as an advanced reference base for students of business administration, both at the undergraduate and graduate level. It is a compact introduction to the subject, even for students of interdisciplinary programs, such as industrial engineering or business law.

When using the key performance indicators, it is important that all concerned parties have a good understanding of their basic contents. Our book helps in achieving this goal in many ways. When searching for a suitable key indicator, its calculation and meaningful usage, the following questions should be answered carefully:

1. What kind of problem needs to be resolved? This would mean specifying the business aspect or the context, which needs to be analysed through an absolute or relative indicator.
2. What kind of data (physical, monetary and time value) is suitable and relevant for the purpose?
3. How can the needed data and information be obtained within the firm?
4. What is the typical value of the indicator, which should be targeted by the firm or which is achieved by other firms?
5. What possible actions are available, or can be applied, to improve the key indicator, which solve the problem or bring it closer to a solution?

This book explains key performance indicators, representing a new form of reference manual. We have developed business-related details for various groups or combinations of key indicators, with the following features:

- Structural navigation of the book around the four dimensions, or perspectives, of the balanced scorecard approach. The financial, customer, processes, human resource/innovation perspectives have been further classified into sub-groups to facilitate targeted referencing. The sub-groups, such as value-based management (VBM), project controlling, and supply-chain management, need to be highlighted, due to the increased need for key performance indicators in these areas.
- The core message of sustainable management is highlighted in this book. It is based on the idea of setting in motion a development process which satisfies the needs of the present generation without jeopardising the needs of future generations. With its emphasis on reporting and performance evaluation at the firm level, the application of the sustainability principle simultaneously tracks three top targets of economic benefits, social responsibility and ecological viability. Therefore, the selected ecological key performance indicators are not shown separately as the fifth perspective of the balanced scorecard approach but specifically integrated in each of the four perspectives.

- Compact indicator profiles with systematically consistent structures:
  - ? The analytical question answered by this indicator.
  - * Definition or Formula for calculation, along with the dimension in which an indicator is expressed;
  - * Calculation/Derivation of the indicator, with the source(s), where the information can be available or sought;
  - # Interpretation and typical range of the indicator;
  - ! Useful suggestions for improving the indicator; and
  - & List of related ratios and additional notes.
- The list of common synonyms for each key indicator provides more clarity about the terminology. In addition to that, a list of related indicators gives an opportunity for the reader to explore new aspects of the indicator under analysis.
- We have also offered specific instructions on which key indicators can be computed by external analysts without any problem, and those that can only be computed by internal analysts. Thus, external analysts can compute all key indicators, where input data is derived directly from the published annual reports, for example, profit indicators.

There are four Appendices at the end of the book: they provide additional suggestions for a systematic handling the subject of key performance indicators:

Appendix I offers a systematic explanation about how one can study and analyse the changes in the relative ratios.

Appendix II is devoted to explaining the basic linkages in the DuPont ratio system, and the three main drivers of return on equity.

Appendix III provides a tabular listing of all key performance indicators in an alphabetical order for easy referencing.

Appendix IV contains a tabular overview of 28 SMART (Specific, Measurable, Attainable, Relevant and Timely) KPIs with the related formulae for giving the reader a suggestive list of KPIs that we believe can give a quick profiling of the firm at a glance within the balanced scorecard framework.

We feel that our readers do not have to be experts in accounting and finance to understand the text. However, once they start understanding the information contained in the text, they will surely be on their way to becoming an expert on interpreting key performance indicators.

1 Basic Indicators

1.1 Technical Productivity

Analytical Question

How large is the technical (pure tangible) yield of an input factor, measured in terms of a particular output unit?

Definition

$$\frac{\text{Output Quantity}}{\text{Input Quantity}}$$

or

$$\frac{\text{Output Quantity of Combined Factors of Production}}{\text{Input Quantity of Deployed Factors of Production}}$$

Examples of different factors of production are: raw material, labour-time, capital, supplies/utilities and area.

Various measures of quantity are: units produced, length, area in square meters, weight and time duration.

The measured value of efficiency may be expressed in units per hour (for example, produced quantity per hour), hours per customer (for example, time consumed per customer), square meter per unit (for example, required packing material quantity per machine) and Kg per hour (for example, produced chemical, measured in Kg per hour).

Calculation/Derivation

The required data for this quotient is prepared from the internal cost accounting system, which is then processed and made available to decision makers in different cost types, cost-centres, and product costing.

Interpretation and Typical Range

With the help of Technical Productivity, a *physical* measure of yield for all production factors is derived.

Since various combinations of production factors (each one measured differently) are used for a particular output, data for measuring Technical Productivity has to be collected and valued for each factor separately. Often the measured value shows individual and partial efficiency.

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Therefore, it is not easy to recommend a typical range for this ratio. A useful interpretation of this ratio is possible over time, when intra-firm or inter-firm comparisons are made over several periods. When making international comparisons, the impact of other value drivers, such as changes in the bilateral exchange rate over time has to be carefully considered.

An important, though simplified, assumption made when calculating this quotient is that the input and output factors have a linear cause-and-effect relationship with each other. It should be emphasized that this assumption of linearity is not always true. Since the deployed factors of production are usually scarce, managers always try to achieve the highest possible yield, i.e. technical productivity.

! Useful Suggestions

The demand for targeted productivity has increased in firms and is often grounded in the need to improve future competitiveness. Through an improved (quantity-based) input-output relationship, the firm should make maximum use of scarce production factors. Improvements in productivity are focused at increasing the yield value of the deployed resource input. Thus, measuring productivity over time is an important step in process-optimization, which is often achieved through skilfulness in avoiding wasted time, energy or effort. Lean manufacturing provides an interesting example of process improvements, which supports the business benefits of rapid execution.

There is one more aspect that needs to be considered. If the input factors of production have substitutes, a part-improvement in productivity may not necessarily lead to total improvement in productivity. Moreover, an improvement in the productivity of a particular factor may well be due to increased consumption of another input factor.

A change in this ratio in the context of desired corporate goals can be achieved by a disproportionate increase or decrease in the achieved output (as numerator) and deployed input (as denominator). *For further details and systematic explanations of this argument, refer to the information in Appendix I.*

& Related Ratios/Additional Notes

"Technical Yield" and "Output-Input Ratio" are often used as synonyms for Technical Productivity. In some cases, productivity is labelled as efficiency, such as material efficiency.

The inverse value of Technical Productivity (input quantity/output quantity) is known as "Production-Coefficient".

In order to make better judgments about the performance of a particular process, it is desirable to measure the outputs (the numerator) in monetary terms. This leads to the calculation of the so-called "economic productivity". If both output and input factors are measured in monetary units, the resultant value will be called

"operating efficiency" In process reengineering, any change that increases economic productivity is considered as an economically efficient change.

1.2 Efficiency

Analytical Question

How large is the relative yield of (or return from) an input factor in terms of a particular output unit? What is the quantifiable relative performance of a particular process, operation or a system?

Definition

The term "efficiency" and various measures, which are related to or derived from it, are not uniformly defined. Some measures of Efficiency relate to "technical productivity", whereas other measures relate to "economic productivity". Mostly, Efficiency is named and described with reference to the input factor, such as material efficiency, labour efficiency (or employee efficiency), energy efficiency, etc.

$$\frac{\text{Output Value (Measured in Monetary Units)}}{\text{Input Value (Measured in Quantity or Monetary Units)}}$$

Some examples of efficiency are: production per employee, energy costs per machine hour, sales per square metre of sales area, and contribution margin per client.

Various measures of quantity are: units produced, length, area in square meters, weight and time-duration.

The measured efficiency value may be expressed in % (in the case of technical quantity-based efficiency) or in € per square meter, € per client, € per unit, € per hour (in the case of economic/value-based efficiency).

Calculation/Derivation

The required data for this quotient is prepared from the internal cost accounting system, which is then processed and made available to decision makers in different cost types, cost-centres, and product costing.

Interpretation and Typical Range

Put simply, Efficiency is a measure of performance. If it is measured in technical terms, it is similar to productivity and implies the yield of a particular production factor. Since various combinations of production factors (each one measured differently) are used for a particular output, data for measuring efficiency has to be collected and valued for each factor separately. Often the measured value shows partial efficiency.

Therefore, it is not easy to recommend a typical range for this ratio. A useful interpretation of this ratio is possible over time, when intra-firm or inter-firm comparisons are made over several periods. When making international comparisons, one has to consider carefully the impact of other value drivers, such as changes in the bilateral exchange rate over time.

An important, though simplified, assumption made when calculating this quotient is that the input and output factors have a linear cause-and-effect relationship with each other. It should be emphasized that this assumption of linearity is not always true. Since the deployed factors of production are usually scarce, managers always seek to achieve the highest possible economic yield, i.e., economic productivity.

! Useful Suggestions

Every measure of Efficiency is aimed at improving the value of the deployed resource input. Thus, measuring efficiency over time is an important step in process-optimization; this is often achieved through skilfulness in avoiding wasted time, energy or effort. Lean manufacturing is an interesting example of process improvement, which helps to achieve the business benefits of rapid execution.

If the input factors of production have substitutes, a part-improvement in efficiency may not necessarily lead to total improvement in efficiency. Moreover, an improvement in the efficiency of a particular factor may well be due to increased consumption of another input factor.

By comparison, producing something at a lower cost than competitors, or achieving a reduction in unit costs over time or reduction in time to complete a job, or reduction in inventory levels are other examples of efficiency improvements.

A change in this ratio in the context of desired corporate goals can be achieved by a disproportionate increase or decrease in the achieved output (as numerator) and deployed input (as denominator). *For further details and systematic explanations of this argument, refer to the information in Appendix I.*

& Related Ratios/Additional Notes

The "Technical Efficiency" and "Economic Efficiency" are two variants of Efficiency. Various synonyms, such as "Output-input ratio", "Productivity" "Technical Productivity", "Technical Yield" or just "Yield", are commonly used for technical efficiency. Typically, the productivity is shown with reference to an input factor, such as material or energy.

The inverse value of technical productivity (input quantity/output quantity) is known as "Production-Coefficient".

Closely related to the concept of technical efficiency is another concept called Economic Efficiency, which is similar to economic productivity. If various input factors which are measured in heterogeneous dimensions, are made comparable by expressing them (in the denominator) in monetary terms, the resultant quotient is called Economic Efficiency.

1.3 Economic Efficiency

Analytical Question

How far is the computed value of the operational output-input ratio good enough, from the economic value perspective? Does the cost-benefit analysis of an operation lead to the creation of value?

Definition

The quotient for Economic Efficiency is an extension of technical and economic productivity, where both numerator and denominator are in monetary terms.

Variant A:	Variant B:	Variant C:
$\frac{\text{Revenue}}{\text{Expenses}}$	$\frac{\text{Benefits}}{\text{Costs}}$	$\frac{\text{Budgeted Costs}}{\text{Actual Costs}}$

The Economic Efficiency is measured in multiples. The goal is to achieve a value above 1, for example, 1.2. If the values in the above variants are multiplied by 100, the result will be a percentage. Thus, a comparable goal is to achieve results above 100 %; for example, 120 %.

Calculation/Derivation

The required data for this quotient is prepared from the internal cost accounting or external accounting reports. In some cases, it is essential to have a direct costing (for segregating costs into variable and fixed) on the basis of budgeted and actual costs.

Interpretation and Typical Range

Economic Efficiency is a core criterion for making capital budgeting decisions. With the help of calculated economic efficiency, a *monetary* measure of yield is established for accepting or rejecting a project.

In all variants of Economic Efficiency, the rule of thumb is simple: the higher the quotient, the better the economic efficiency. However, sometimes values below 100 % are also possible, particularly in non-profit organizations (NPO), where the focus is not on profit-maximization. Instead, NPOs may choose projects based on the highest possible cost coverage.

Useful Suggestions

In order to influence this ratio positively, the numerator could be improved through a better price or volume strategy. The denominator (i.e., cost side) could be optimized through a more efficient use of the factors of production.

An important, though simplified assumption made for calculating this quotient is that the variable and fixed costs remain constant over time. However, if the

output volume increases or reduces over time, the Economic Efficiency may change over- or under-proportionately because of the changing behaviour of the fixed costs (the so-called capacity effects).

Furthermore, as in similar ratios, the reduction of overheads or other cost-components should not lead to an over-proportionate reduction in performance; otherwise the expected improvement in economic efficiency may not be achieved. Simply speaking, the austerity measures should not create counter-productive effects.

A change in this ratio, in the context of desired corporate goals, can be achieved by a disproportionate increase or decrease in the achieved output or benefit (as numerator) and deployed input or costs (as denominator). *For further details and systematic explanations of this argument, refer to the information in Appendix I.*

& Related Ratios/Additional Notes

Economic Efficiency is also known as "Operational Efficiency" or "Cost-Benefit Analysis".

A closely related family of ratios that help in measuring Economic Efficiency is called "Profitability Ratios". Thus, various measures of profitability (with capital or sales as input variables) assist us in establishing economic efficiency.

Many banking institutions use the "Cost-Income Ratio". The ratio (actual-actual or budget-actual) helps in making diverse intra-firm and inter-firm comparisons, both in national and international contexts.

1.4 Profitability

? Analytical Question

How much is the relative Profitability, computed by comparing any indicator of periodic performance with the deployed resources? What is the ability of a business to generate profit (i.e. return) when compared with the capital employed or sales volume?

* Definition

Four basic variants of Profitability are possible:

Variant A:	Variant B:	Variant C:	Variant D:
$\frac{\text{Profit}}{\text{Capital}}$	$\frac{\text{Profit}}{\text{Sales}}$	$\frac{\text{Net Cash Flow}}{\text{Capital}}$	$\frac{\text{Net Cash Flow}}{\text{Sales}}$

If the values in the above variants are multiplied by 100, the result will be as a percentage.

For computing the capital employed in the denominator, instead of the ending balance, the average volume of capital employed is often taken.

Calculation/Derivation

The required data, depending upon the chosen profitability variant, can be obtained from the published external financial reports or from the internal cost accounting information system. The information may also be available in from the internal capital budgets or financial reports.

Interpretation and Typical Range

Profitability is the most important measure of performance in any business decision. It is used to assess a business's ability to generate earnings in comparison to its expenses and is expressed as a relative measure.

For all capital or sales related profitability ratios, the valid statement is: the higher the Profitability, the better the earning-capacity and, consequently, the higher the self-financing capacity of the firm.

Unlike the "classical" Return On Sales (defined as operating profits/sales), in Cash Flow Margin (akin to EBITDA-turnover-yield), cash inflow is matched with sales, which cannot easily be influenced by balance sheet related policy decisions, and therefore, is considered more meaningful than any other measure based on earnings.

By comparison with the "classical" gross or net return on sales, the Cash Flow Margin Ratio carries the advantage of neutralizing many of the differences which arise because of divergent international legal directives and practices. Thus, international comparisons based on this ratio are useful.

In principle, for the calculation of Return On Equity, both profit *before* or *after* taxes can be taken. The calculations based on after tax profits (i.e., net income) are obviously more common. However, if non-incorporated firms (not liable to pay taxes) are compared with tax-liable corporate firms, it would be sensible to measure the profit before tax.

It is difficult to make recommendations about the target profitability. Obviously, the rule of thumb is that the Profitability should be higher than the financial costs. For orientation and benchmarking this ratio, one could take internal comparisons (such as the ratio in different organizational units or plan-actual values) or external comparisons where the branch-specific average period or the "best-practice" value may be used as a guide.

Assuming that the comparable firms have a similar structure of products, processes or potentials, any variance from the average values provides clear indication for serious reviews. These should help in analysing the positive and negative developments in the ratio, and steer them in the context of corporate goals.

Useful Suggestions

In order to influence this ratio positively, the numerator could be improved through a better price/volume strategy on the sales side, and through a more efficient use of the factors of production on the cost side. Any business strategy that promotes

high-yield (or discourages low yield) products and services would invariably lead to an improvement in profitability. In individual cases, one has to analyse the effects of those factors which cut across the time dimension; thus for example, products and services in varying life-cycle phases have different levels of profitability. Similarly, sometimes a product-mix-effect demands that products with lower-margins may be continued, in order to support and complement other high-margin products.

In the denominator, a reduction in the asset base could be achieved through selling of non-operating assets (at least at book value) or a reduction in inventory levels. Asset leasing is another common measure for reducing the denominator. Thus, even with constant (or declining) earnings, the profitability can be improved because of a lowered asset base.

A change in this ratio, in the context of desired corporate goals can be achieved by a disproportionate increase or decrease in the earnings (as numerator) and deployed assets or sales volume (as denominator). *For further details and systematic explanations of this argument, refer to the information in Appendix I.*

& Related Ratios/Additional Notes

Along with the classical measures of "Return On Equity", "Return On Assets" and "Return On Sales", in the recent past, there is a stronger tendency to calculate the cash flow based "Return On Equity" and "Return On Assets". *For details on these ratios, as well as for other ratios (such as ROI and CFROI) in the family of profitability ratios, refer to the appropriate terms in the Index.*

In the case of responsibility-centres (such as sales offices or profit-centres), which use profitability ratios for planning and controlling purposes but have no influence over financing and other decisions, the profitability ratios are generally calculated "Before Interest" and "Before Taxes".

1.5 Turnover Rate

? Analytical Question

How often is the average inventory of a particular asset turned over into sales during a period?

The ratio can be applied to a variety of assets or objects, for example, to inventories of different kinds.

* Definition

$$\frac{\text{Average Sales, Need or Consumption}}{\text{Average Inventory}}$$

The ratio is expressed in terms of multiples and could have a decimal value as well.

The numerator can be the average sales, need, consumption or outflow.

In the case of real assets, instead of using the quantity-based data for numerator and denominator, it is also common practice to take value-based data. However, for an inter-firm or time-series comparison of the value based result, it is important to check the consistency of the valuation base for the inventory amount. The valuation could be based on acquisition price or sales price, current price or average price, or appropriate production costs.

Calculation/Derivation

The required data, depending upon the level of aggregation of the chosen products, can be obtained from the information system of (internal and external) accounting. For example, the data can be based on an ERP (Enterprise Resource Planning) system with a module-based structure. Among others, a familiar name of ERP software is SAP R/3 or S/4 HANA. The data could also be obtained from corporate capital budgeting documents.

Interpretation and Typical Range

The Turnover Rate belongs to the category of "activity ratios". It shows the arithmetical intensity of an asset-use or consumption in the business processes.

A general target range for this ratio cannot be determined. For orientation and benchmarking, one could take internal comparisons (such as the ratio in different organizational units or plan-actual values) or external comparisons where the branch-specific average period or the "best-practice" value may be used as a guide.

Useful Suggestions

Assuming that firms in the same branch usually have similar production and asset structures, the ratio values, differing significantly from the averages, are clear candidates for serious reviews. These should help in analysing the positive and negative consequences and steering them in the context of corporate goals.

In trading companies, Turnover Ratios constitute a central measure for steering the supply chain management. This is primarily because trading companies do not have any production of their own.

The significance of the Turnover Rate is evident when we view stock number as "capital", particularly in the context of the ROI framework. The Profitability (Net Income/Capital) as a key ratio is extended into two ratios, where Return On Sales is based on EBIT/Sales and Asset Turnover is based on Sales/Average Assets. *For additional explanation about this multi-layered ratio systems, refer to the DuPont System in Appendix II as an example.*

The multiplicative link between "Return on Sales" and "Asset Turnover" ratios in ROI shows that a firm can maintain its profitability despite a fall in the return on

sales, if it is able to improve its asset turnover ratio. For this, the short, medium, and long-term impact of all the measures, which reduce the asset base without negatively influencing sales-generating capacity has to be carefully evaluated.

Similarly, a rise or fall in the profitability of the enterprise could be analysed with reference to return on sales and/or asset-turnover, and measures for improvement can be developed. This analytical perspective, and the derived conclusion, can be applied to all other ratios in the category of "turnover" as well.

A change in this ratio could be triggered by a disproportionate increase or decrease in sales as a measure of flow (as numerator) and inventory as a measure of stock (as denominator). *For further details and systematic explanations of this argument, refer to the information in Appendix I.*

& Related Ratios/Additional Notes

The word "Turnover Coefficient" is often used as a synonym for "Turnover Rate".

If the numerator and denominator are turned upside down, the resultant coefficient is called "turnover period" or "turnover time" or simply "coverage".

1.6 Elasticity

? Analytical Question

How strongly does the value of a dependent factor react to a change in the value of an independent factor, with both measured in percentages? For example, to what extent is the failure rate expected to change when the time allocated to the training of employees increases by 15 % in terms of error-prevention measures?

* Definition

$$\frac{\text{Relative Change in dependent Factor}}{\text{Relative Change in independent Factor}}$$

Since both the numerator and the denominator are percentages, Elasticity is a dimensionless, usually non-integer value. Depending on the implicit relation between the two variables, it can be positive as well as negative (for example, -1.2).

» Calculation/Derivation

In practice, prerequisites are often lacking for (i) a system-based functional relation (backed up by calculations) or (ii) a regression analysis, which can produce statistically valid results. Therefore, either observation based on small patterns of reaction, or simple estimations based on previous experience, are carried out to derive common elasticity-assumptions.

Interpretation and typical range

Despite the insufficient availability of analytical data, determining robust and conclusive cause-effect-relationships or end-means-relationships is a matter of necessity and utmost importance in management control. When the relation between two values isn't directly based upon a mathematical operation (for example, gross price minus discount equals net price), all that remains in practice is the ability to make relatively well-founded assumptions and suppositions.

In the case of decisions involving multiple people, either through active participants, or through the inclusion of subordinates and superiors who need to be involved, the assumptions (such as those relating to elasticity) need to be objectively disclosed. This is important in encouraging rational corporate management as well as promoting mutual understanding for decision-making and action.

The economic and theoretical foundation of changing circumstances, and the intensity of their objective relationships are of essential importance for management, especially when various economic parameters are applied and, sometimes, their correlation in multi-layered KPI systems need to be understood. Thus, the validity of the tools in Balanced Scorecard is significantly reinforced by the quality of these objective dependency-relations (for example in the form of so-called strategy-maps with cost and value drivers).

Taking into account the variety of entrepreneurial malleable interdependent factors within a functional area, and between different levels of an organization, a generalized target value for the extent of each type of elasticity, obviously, cannot be determined.

For orientation and benchmarking elasticity, one could take internal comparisons (such as the ratio in different organizational units over time or budget-actual comparisons) and corresponding external comparisons, where the branch-specific average values or the "best-practice" values may be used as a guide.

Useful suggestions

In the name of simplicity, the fundamental form of the relationship between two variables is assumed to be implicit (so-called "mono-causality"). This is usually the basis for the implementation of various measures.

In most business decisions though, there are multiple parameters that are related in end-means-relationships, especially when one must take into account socio-cultural and environmental parameters because of sustainability concerns (so-called "multi-causality"). The complexity of this network of relationships is usually further increased by the fact that there is not just one but multiple targets, or a corporate goals-system with multiple levels of target priorities.

To be able to conduct the business activity in a company more effectively, the following areas of cause-effect-relationships between independent and dependent variables (in their respective corporate situations) have to be taken into account when determining elasticity:

- complementary, competing and neutral relationships
- linear (proportional) correlations but also those gradients having different levels of steepness over a period of time (so-called deviating correlations)
- progressive versus digressive trends
- stable or unstable, i.e. existentially threatened relationships in the time period being observed, potentially through disruptive internal or external influences
- immediate or lagged correlation between two variables (depending upon the length of delay).

The breadth of the fundamental spectrum of corporate areas of analysis during the derivation of cause-effect-relationships and the related calculation of elasticity should show how demanding the choice of appropriate indicators, and their integration into performance management systems are. This should adequately portray the reality of complex operational routines within a company.

& Related Ratios/Additional Notes

The concrete forms for special applications of elasticity concepts in management, especially in marketing and pricing policy are:

- Price Elasticity of Demand (Refer to KPI No. 3.3.6)
- Cross price elasticity of demand
- Income elasticity of demand

Other economic connections, in the form of cause-and-effect relationships, are also possible within the framework of this KPI.

1.7 Compound Annual Growth Rate (CAGR)

? Analytical Question

Relatively speaking, to what extent has a business parameter value changed on average within a multi-periodic comparison?

For example, by what percentage has the number of employees increased (called growth rate) or the revenue decreased (called decline rate) over a period?

* Definition

$$(1+v) = \left(\sqrt[n]{(1+v_1)\cdot(1+v_2)\cdot(1+v_3)\cdot\ldots\cdot(1+v_n)}\right)$$

Wherein:

v – Compound average rate of change per period
v_i – rate of change in period I (i = 1, 2, 3. . .., n)
n – maximum observed number of periods
1+v – average change factor per period

The rate of change is given as an absolute number. For example, a value of 0.15 corresponds (using the multiplying factor "100") to a growth rate of 15 %; a negative value of -0.028 corresponds (using the multiplying factor "100") to a decline rate of 2.8 %. The respective change factors in the calculation formula account for 1.15 and 0.972.

If in a practical case – and with continuous solely positive or continuous solely negative values – there are only the first and last observed values of a numerical series (with n periods) available, the simpler calculation formula can be applied:

$$(1 + \mathrm{v}) = (\text{Final value}/\text{Initial value})^{(1/\mathrm{n})}$$

Rates of change are often (after multiplying by "100") interpreted as percentages (i.e. stated "in per cent", e.g. 1.8 % decline). In contrast, an increase or decrease in the rate of change is indicated "in percentage points" (the increase of the complaint rate has risen, e.g. from 4.2 % by 1.5 percentage points to 5.7 % or has halved by 2.1 percentage points to 2.1 %).

Calculation/Derivation

The data for the purpose of this KPI has to be gathered from the equidistant time series. Furthermore, the data should be extracted in accordance with the issue under analysis (for example, external values with global, national or industry relevance or internal values with organizational structure relevance in a company) from the appropriate statistical sources, as well as from the accounting information systems.

Interpretation and Typical Range

With the compound annual rate of change (v, henceforth CAGR), the average percentage change of a business relevant value per period within the course of time is determined. It may be an average increase (value of $v > 0$; e.g. increasing revenue), an average stagnation (value of $v = 0$; e.g. price stability), or an average decrease (value of $v < 0$, e.g. declining number of customers).

The choice of a periodic reference value depends highly on the research object – usually years, quarters or months are the corresponding reference periods for comparison. Basically, absolute stock values (e.g. inventory volume), absolute flow variables (e.g. operating incomes), as well as relative values (e.g. profit margins) can be considered as business issues worth analysing.

From a mathematical point of view, when determining the parameter CAGR, the so-called geometric mean of the changed values that belong to the individual periods is calculated. The issue of analysis needs to be ratio-scaled (indicating quantity, value or percentage, as for example number of pieces sold, fixed costs or capacity utilization) and all characteristic values need to present a solely positive or negative value (e.g. number of employees or partial loss). For a value-series with positive and negative values (for example gains and losses), it is not possible to

determine a significant CAGR. Consequently, the geometric mean is arithmetically the n^{th} root from the mathematical product of all observed change factors (i.e. all corresponding rates of change plus 1).

A generalized specification for the amount of the corresponding average rates of change is not determinable. With business-guided circumstances, the organizational goals, fixed by the company, serve as an important measuring stick. As an orientation for the magnitude of the rates of change, one could take internal comparisons (such as the ratio in different organizational units or budget-actual comparisons) and/or corresponding external comparisons, where the branch-specific average values or competitor's data or the "best-practice" values may be used as a guide.

! Useful Suggestions

As the CAGR represents a general mathematical measure for the percentage increase or decrease, it is useful for reporting, as well as universally applicable in all functional areas and on all organizational levels of management. Consequently, it is a central instrument for the numerical presentation of corporate growth.

As far as the subject of analysis is manoeuvrable over time, for example, contribution margins per product or fixed costs per factory site, appropriate management measures will have to be planned and implemented if the developments do not meet the target corporate goal. These days, managers increasingly choose relative targets (as against absolute targets), like "wanting to grow faster than the market" or "being more profitable than the biggest competitor".

In light of the widespread applications of the parameter CAGR, it is important to be aware of the substantial possibilities and limits of this interpretation. The shorter the observation period, the stronger the influence of individual (particularly positive or negative) fluctuations/volatilities on the average rate of growth or decline rate within the time period. By contrast, the longer the observation period, the greater is the likelihood of an alignment process and a levelling of extreme values happening. Seasonal fluctuations are not apparent from the average value. Likewise, one has to consider the so-called base effect; Identical increases in absolute values in relation to a smaller starting point, project a high growth rate, whereas in relation to an already high base, it projects a small growth rate.

Also, the difficulty of choosing a reference date or period (with a particularly low or high starting value) as a base for calculating the rate of change, needs to be considered for industry wide comparisons.

From the sole information of the CAGR, it is not possible to detect clear trends. The possible time series of change rates "10 %–8 %–6 %–4 %" or 4 %–6 %–8 %–10 %" lead to an identical average rate of change (v=0.0697, consequently 6.97 %), although completely contrary underlying developments are happening in each case.

Analogically, if this time series had negative percentage values as decline rates (for example for the yearly operational waste generation), an annotation could arise

that distorts the real situation. The forward projection of future time periods is likewise, problematic. Only when making a comparison with earlier average rates of change can reliable findings be obtained.

Related Ratios/Additional Notes

The term CAGR is a generic term for growth rate or decline rate. In many cases corresponding combinations of synonyms for both root words are used, for example, growth rate. Occasionally, in cases of shrinking markets, the term "negative growth rate" is used.

By comparison with the geometric mean, where compound average increases or decreases are calculated, the arithmetical mean calculates the average value of the observed absolute stock or flow values (for example average total assets or staff costs) or the average value of relatively expressed parameters (for example: equity ratio).

2 Financial Perspective

2.1 Profit Indicators

2.1.1 Earnings before Taxes (EBT)

Analytical Question

How much are the earnings before taxes?

Definition

	Net Income or Loss
+	Taxes on Income and Profits/(– Tax Refund)
=	EBT (Earnings before Taxes)

The financial reporting under IAS/IFRS rules prohibits the explicit demarcation of extraordinary results. Instead, IAS/IFRS rules require a declaration of the "Results from Discontinued Operations".

The figure of EBT is stated in absolute currency units (for example, in €).

Calculation/Derivation

The data for this purpose can be obtained from the income statement contained in the annual reports (or quarterly reports).

Interpretation and Typical Range

The EBT is an indicator, belonging to the category of Pro forma ratios (the so-called "Earnings before. . ."-Family) which have emerged in the context of IFRS-Accounting.

To calculate the annual results, the revenues have to be added and expenses have to be subtracted. For specific analysis and information purposes, it may, however, be helpful to make special adjustments to the declared results. These adjustments, to a greater or lesser extent, lead to various intermediate or (as the case may be) to pro forma results, which deliver a subjective result. The "Earnings-before. . ." ratios provide estimates of earnings, as if the special adjusted expenses and/or revenues had not taken place in the firm. This helps in improving comparability over time and between firms. However, it can also lead to distortions and unclear comparisons, if unilateral changes in terminology made by the firm were not explicitly communicated.

The core of the EBT as an indicator represents the annual (or quarterly) net income, which according to the income statement is an *after-tax* number. However, the after-tax number is "neutralized" for the taxes paid. As a result, EBT is a pre-tax number.

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For the absolute level of EBT, no generalization about a target number is possible. When comparisons are made over time (for the whole firm or parts thereof), a trend analysis (continuous increase or fall, highly fluctuating, etc.) of EBT over time has significant explanatory power. The explanatory value of EBT can be further increased by analysing it vis-à-vis sales or assets. This allows us to measure relative profitability which can be used for comparing firms of different sizes.

! Useful Suggestions

EBT should be used as a benchmark for comparing operating earning capacity in companies across different tax jurisdictions. An explicit calculation of results before income tax provides a good base, if the comparison is being drawn between firms having different forms of business organization or between firms in different tax regimes, and, last but not least, between firms operating internationally.

In order to influence this financial indicator, on the sales side, EBT could be improved by a better price or volume strategy. On the expense side, EBT could be improved by a more efficient use of the factors of production. As good examples of improving EBT, actions, such as focusing on profitable segments of products and services, careful price increases, and targeted control of variable and fixed costs be recommended.

& Related Ratios/Additional Notes

Often, Profit before Taxes (PbT) is used as a synonym for EBT. However, some experts believe that the term "profit" includes both operating and non-operating profits.

Related ratios are: EBIT, EBITA, and EBITDA.

In general, the adjustments made in the calculation of "Pro-forma ratios" are non-recurring, mostly in abnormal and non-sustainable circumstances, which are shown in the income statement as business-related or non-business-related items. They are mostly viewed as "noise factors" which could influence a "fair view" of the wealth, financial and earnings position of the firm.

For deduction of taxes, one should consider only the taxes on income and profits. The other forms of taxes should not be deducted.

2.1.2 Earnings before Interest and Taxes (EBIT)

Analytical Question

How much are the earnings from operating business before interest and taxes?

Definition

	Net Income or Loss
+	Taxes on Income and Profits/(–Tax Refund)
=	EBT (Earnings/Income from Operating Business before Taxes)
+	Interest Expense
=	EBIT (Earnings/Operating Income before Interest and Taxes)

The financial reporting under IAS/IFRS rules prohibits the explicit demarcation of extraordinary results. Instead, IAS/IFRS rules require a declaration of the "Results from Discontinued Operations".

The figure of EBIT is stated in absolute currency units (for example, in €).

Calculation/Derivation

The data for this purpose can be obtained from the income statement contained in the annual or quarterly reports.

Interpretation and Typical Range

The EBIT is an indicator, belonging to the category of Pro forma ratios (the so-called "Earnings before. . ."-Family) which have emerged in the context of IFRS-Accounting.

The calculation of EBIT shows the operating earning capacity of a firm, independent of its capital structure and income tax burden. As an indicator, it is suitable for comparing profitability (when used along with sales or asset base), between firms, parts thereof, profit centres or segments.

The core of the EBIT as an indicator represents the annual (or quarterly) net income, which, according to the income statement, is an *after-tax* number. However, the after-tax number is "neutralized" for the tax payment and the interest expense. As a result, EBIT is a pre-tax number, which also removes the leverage effect (in the form of interest expense).

To calculate the annual results, the revenues have to be added and expenses have to be subtracted. For specific analysis and information purposes, it may be helpful to make special adjustments to the declared results. These adjustments, to a greater or lesser extent, lead to various intermediate or (as the case may be) to pro forma results, which deliver a subjective result. The "Earnings-before. . ." ratios provide estimates of earnings, as if the specially adjusted expenses and/or revenues had not occured in the firm. This can help in improving comparability over time and between firms. This can, however, also lead to distortions and

unclear comparisons, if unilateral changes in terminology made by the firm were not explicitly communicated.

For the absolute level of EBIT, no generalization about a target number is possible. When comparisons are made over time (for the whole firm or parts thereof), a trend analysis (continuous increase or fall, highly fluctuating, etc.) of EBIT over time offers significant explanatory power. The explanatory value of EBIT can be increased by analysing it vis-à-vis sales or assets. This allows us to measure relative profitability, which can be used when comparing firms of different sizes.

! Useful Suggestions

EBIT should be used as a benchmark to compare the operating earning capacity between companies across different tax jurisdictions or compare companies with different capital structures. An explicit calculation of results before income tax provides a good base, if the comparison is being drawn between firms having different forms of business organization, or between firms in different tax regimes, or between firms operating internationally.

In order to influence this profit indicator, on the sales side, EBIT could be improved by a better price or volume strategy. On the expense side, EBIT could be improved by a more efficient use of the factors of production. As good examples of improving EBIT, actions such as focusing on profitable segments of products and services, careful price increases, targeted controlling of variable and fixed costs be recommended.

& Related Ratios/Additional Notes

Sometimes, Profit before Interest and Taxes (PBIT) is used as a synonym for EBIT. However, some experts believe that the term “profit” includes both operating and non-operating profits.

Related ratios are: EBT, EBITA, and EBITDA. In the network of Pro forma ratios, along with these three, EBIT is the most widespread indicator of profitability.

In general, the adjustments made in the calculation of “Pro-forma ratios” are non-recurring, mostly in abnormal and non-sustainable circumstances, which are shown in the income statement as business-related or non-business-related items. They are mostly viewed as “noise factors” which could influence a “fair view” of the wealth, financial and earnings position of the firm.

In the deduction of taxes, one should consider only the taxes on income and profits. The other forms of taxes should not be deducted.

If both incomes and expenditures of a particular item (for example, interest expenses and interest income) are matched in the income statement for neutralizing the Pro forma ratios, it is called treatment parity. When only the revenue or expense side is considered, it is called treatment disparity. This approach is indeed the case in EBIT calculation, where only the interest expense is added back to the earnings.

If comparisons are made over time and between firms, it must be based on a clear and consistent foundation of definitions. Otherwise, the conclusions drawn may be of limited use.

Over time, there are many new variants, which have been added to the "Earnings before. . ." Ratios, and thus it is difficult to mention each variant. Some examples of the alphabets added to EBIT are as follows:

A = Amortization
D = Depreciation
DT = Deferred Taxes
I = Interest
R = Rents
SO = Stock Options
X = Exploration Expenses

Thus, different kinds of interpretations are used in the internal reporting system for these indicators. Often, these indicators are not comprehensible to external parties, and have been exposed to increasing criticism.

2.1.3 Earnings before Interest, Taxes and Amortization (EBITA)

Analytical Question

How much are the earnings from operating business before interest, taxes and amortization (of intangible assets)?

Definition

	Net Income or Loss
+	Taxes on Income and Profits/(–Tax Refund)
	EBT (Earnings/Income from Operating Business before Taxes)
+	Interest Expense
=	EBIT (Earnings/Operating Income before Interest and Taxes)
+	Amortization of Intangible Assets, including Goodwill
=	EBITA (Earnings before Interest, Taxes and Amortization)

The financial reporting under IAS/IFRS rules prohibits explicit demarcation of extraordinary results. Instead, IAS/IFRS rules require a declaration of the "Results from Discontinued Operations".

The figure of EBITA is stated in absolute currency units (for example, in €)