DIAGNOSIS COSTS IN METALLURGICAL ENTERPRISE

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Abstract

The high cost of inputs and their continual change, efforts to retain core employees, unrealistic environmental standards, limits, taxes, levies and fees are increasing at the Czech metallurgical companies fixed costs and making them less competitive. This makes diagnosis costs in metallurgical companies, records any changes to the cost, consistently looks for the causes of changes including conservation point of view of an individual approach, even more important than before. Whether you choose already being used new or traditional approaches to monitoring, control and evaluation of costs using economic and mathematical methods, the needs of current metallurgical companies must be especially met - to achieve a radical increase in the effectiveness of all available company resources.

Keywords: Costs, Break Even Point, CVP analysis, Regression analysis, Time lines, Benford's Law

1. THE USE TO ECONOMIC DIAGNOSTICS

Economic diagnosis is a science dealing with the recognition and evaluation levels of functioning of the enterprise as a system, the total value of company (the company's creditworthiness), strengths and weaknesses of the company, problems and crisis phenomena in the company, including possible termination and unused opportunities and potential of enterprises [1] .

The most important principles of the diagnostic process usually very long-term:

- record all changes,
- consistently seek the causes of observed phenomenon - this part is very difficult,
- keep an individual approach.

To initiate changes is necessary to fully understand the current status and the nature of its business development. Diagnosis of the company is mainly used to determine whether the detected condition is only temporary or is a chronic condition, or whether the overall trend is even threaten the functioning of the company . [1] Diagnosis of economic datas is often a very difficult process because the obtained data are very complex. Its aim is to interpret and evaluate the results of which are then used for the synthesis of the data, the conclusion diagnosis and prognosis - enabling you to understand the current state, its genesis and helps to identify development of the system and to establish the prognosis. For making the diagnostic conclusion there is a need to realize that a definitive conclusion can be pronounced after verifying the accuracy of the proposed methods.

If we are in any areas of the company to make changes or innovations or want to compare with the competition, we need to know the parameters measured or quantified [1] .The problem common to many companies is that they often choose to measure what is easy to measure instead of what is necesary. Without paying enough attention to the design of measurement that the company wants to use, the company creates measurement systems leading to completely inappropriate yet unintentional behavior [2]

Most occurring diagnosing problems in practice:

1. Diagnostician´s lack of skills and lack of competence.
2. Use of (inappropriate, wrong) diagnostic methods.
3. Superficial interpretation.
4. Rapid diagnosis, one-off tests, lack of supervision, etc .

To avoid these problems, it is good to use mathematical statistical methods described further, whose use is relatively simple, while using computer technology [1] .

2. DIAGNOSIS COSTS IN METALLURGICAL COMPANY

2.1. Analysis and sorting costs

One of the basic tasks of management is to manage costs. Cost management requires their detailed classifications. The costs can be sorted by many aspects. In business, the costs are classified according to species (species costs sorting, which is applied in the financial accounts or in the profit and loss attachment), by purpose (special-purpose sorting costs), according to changes in cost depending on the volume of production (by variability of costs) by the origin of consumed inputs, etc.

We use two basic criteries for targeted costs sorting:

- By place of origin and responsibility,
- According to performance.

Sorting by place of origin and responsibility is sorting by internal departments and clearly shows where costs are made and who is responsible for their creation. Also it is called responsibility accounting. Sorting by performance is also called the calculation cost sorting. Sorting of costs depending on the volume of production is sorting based on dependence of changes in production volume, which there is very important for a large number of quality management decisions. Most of these decisions are in fact variations basic considerations how changes in the volume and range of performance affects the amount of costs, revenues and profits. From this perspective, we divided the costs into fixed and variable.

Fixed costs are those which, depending on the production volume remain unchanged. These costs generally secure overall operation of the company. Characteristic of fixed costs is they are spent even before the start of production. Although these costs are fixed, unchanging depending on the volume of production, but can change depending on the change in production capacity or a substantial change of the production program.

Variable costs are entirely dependent on the volume of production. One of the typical examples of such support is to obtain information about the minimum production capacity utilization (following the possible volume of sales at a price accepted by the customer) in which all fixed and variable costs are paid, and production is not profitable or unprofitable. Economic theory for this state uses the term breakeven point. Mathematical apparatus, based on a calculation called - Contribution to cover fixed costs and profit (Contribution Margin) - is very simple.

2.2. Specifics of costs in metallurgical companies

Experts agree that in order to relaunch the overall growth of steel production in the Czech Republic it is necessary to use the potential strengths of Czech industry, which are the skilled workforce and high quality research institutes.

This effort to keep qualified core employees, high cost of inputs and their continual change, unrealistic environmental standards, limits, taxes, levies and fees are increasing at the Czech metallurgical companies

fixed costs and making them less competitive. This makes diagnosis costs in metallurgical companies, it means recording any changes to the cost, consistently looking for the causes of changes including maintaining individual approach, even more important than before.

The key problem of the above-presented analysis Break Even Point, is an objective calculation of cost classification of items into fixed and variable, thus determining their absolute amounts depending on changes in volume production. In practice empirical method - based on the nature of the individual costing items and practical experience with their development in previous periods - is often applied. It turns out that if this method is performed by experienced professionals, then the results can quite accurately describe the real progress of the cost function. However, there comes a need to verify objectively this empirical distribution costs evaluating the actual costs (over a longer period), especially using the methods of statistical analysis.

2.3. The methods used for diagnosis costs in metallurgical companies

Managerial decisions in the current difficult market conditions cannot be based only on intuition and practical experience of manager. In many cases it is necessary to rely on materials for the decision on objective calculations using economic and mathematical methods.

As a best objective verification (proportion of fixed and variable costs) tools appears to be the methods of statistical analysis, specifically - regression and correlation analysis (of time series and production costs).

Here are two basic problems:

- Obtaining a sufficiently long time series,
- Compliance with pricing, product and methodological comparability of data.

Regression and correlation analysis explores - the relationship between two random values (variables), and if the relationship between them exists, it express it mathematically. Correlation is used to analyze the tightness (forces) between two random values (but not to the prediction), whereas regression seeks this dependence and allows predictions.

Other methods suitable for that use for diagnostic costs in metallurgical company are time series and structural analysis.

The most important method to predict future developments is the analysis of time series. Time series means a sequence of observations quantitative characteristics arranged in time away from the past to the present. Knowledge of patterns of development time series and analysis of the causes that led to them, allows anticipating future developments of these series. This helps economists to better estimate the likely situation in their business and the conditions in which they do business in the next period, so they can plan ahead their activities.

Methods of structural analysis perform quantitative analysis of the development of the reproductive process of the economic system - it can be used in the disproportion between production and raw material resources, while disproportion between internal consumption, final consumption and overall production levels, for predicting prices, etc. [3].

Regression and correlation analysis, analysis of the trends and structural analysis are very well - known and traditional methods used in economic calculations. The article also deals with using Benford's Law for economic calculations in metallurgical companies. This law is generally less known.

Consider any set of numeric data, which represent the value of certain naturally defined quantities of the real world. It does not matter whether it is geographic data, macroeconomic, prices of goods in supermarkets, tables of physical constants, the values of some functions in a certain domain of discrete and so on.

In these files around 30% of the numbers start with number one and the higher the first digit is, the less likely it is to appear at the beginning of numbers.

This law (regularity) was first published in 1881 by an American mathematician and astronomer Simon Newcombe [4] in the journal The American Journal of Mathematics. His claim was based on the observation that in the logarithmic tables in the technical library are obviously the most thumbed page numbers starting with number one.

For long decades, however, his claims were ignored. In 1938 at some point this natural phenomenon was rediscovered by physicist Frank Benford [5]. He was interested in the whole issue more systematically.

It is interesting that perhaps the first significant mention of this law in English is a short article by proffesor Kantorek from 1998 in the journal Vesmír (The Universe) [6]. Pavel Kantorek is a famous Czech cartoonist who studied physics at Masaryk University; in 1968 he immigrated to Canada and currently is a professor of physics at the University of Toronto. In his article he notes: "This is not a mathematical trick, but the actual law of nature, which is used by files of any natural data, regardless of their nature or physical units. The only condition is that the data must be a minimum of three logarithmic scale intervals "[7]..

Especially in the last twenty years there have been many reports of different expertise in international journals that are dedicated to this "first digit phenomenon".

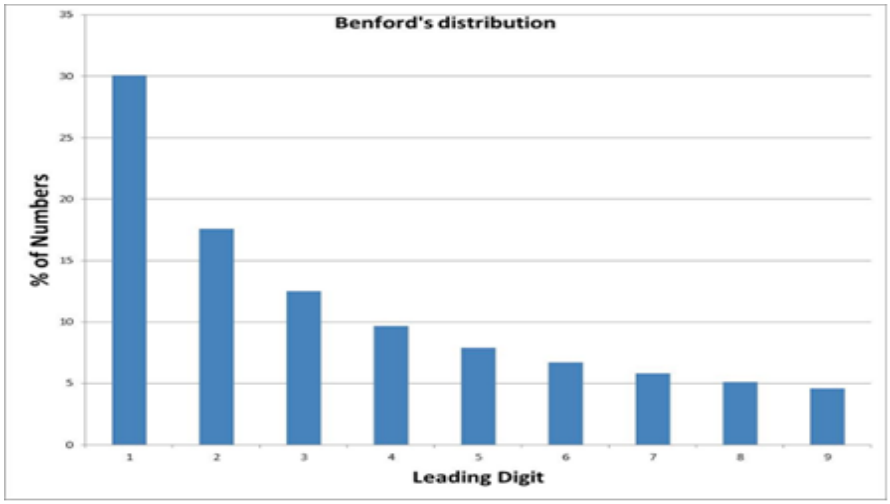

Fig. 1 Benford's Law [12]

Currently the website Benford Online Bibliography [6,10] contains more than 600 references to these posts. There are still many unresolved issues regarding Bernford´s Law, both in terms of purely mathematical, and especially in terms of the possibility of its practical use for example in economic analysis.

Recently in the Czech Republic there has been conducted fairly extensive analysis of business entities in the field of accounting data, which confirmed the validity of the Benford's model [7,11].Benford's law was verified on an analysis of sample of 4.35 million accounting transactions. These areas of financial accountings were examined [6,8]:

- The entire accounting file.
- Costs area.
- The area of financial assets.
- Area of issued and incoming invoices.

2.4. Practical examples of the use of methods for diagnosing costs in metallurgical companies

This article describes both the calculation of a breakeven point in specific conditions of pipes drawing mills (alternatively according to the origin of the feed) as well as tries to verify the relevance of the used empirical distribution of fixed and variable cost using regression and correlation analysis of time series of the results of past periods in the practical part. And also presents results of the verification Benford's law for costs analysis. The historical dates of pipes drawing mill were used.

The Break Even Point calculation was made in two versions for different proportions of arches and pipes. For classifying the proportion of fixed and variable costs there was applied simplistic assumption that variable costs include the cost of feed, all other costs are fixed.The critical point of an objective calculation of breakeven point is right specification of cost items on fixed and variable.

Table 1 Total Costs and Revenues

Peroid	1	2	3	4	5
Production	9 285	8 246	6 153	9495	10 100
Total Costs	238 852	239 476	213 809	336 560	352 463
Costs (in tonnes)	25 725	29 041	34 749	35 446	34 897
Revenues	171 308	167 773	145 961	263 166	308 856
Price (per tonne)	18 450	20 346	23 722	27 716	30 580

In our particular case, data were available for 5 consecutive years, which allowed demonstrating the calculation procedure but the number of observing years should be higher for objective evaluation of results. The fundamental problem is comparability of price and assortment factors that have strong influence on the level of variable costs. In this case, the effect of price changes on the level of variable costs was higher than the impact of changes in production volume. The result was derived cost function with a negative fixed cost, which is in practice unrealistic.

Given that the data on changes in prices over the evaluated period were not available, index of the prices of finished products was used for converting time series variable costs. Under this simplifying assumption then was derived cost function (y = 26,538*x + 98 892), according to variable costs were to about 70% of the total cost. Previously expected number was about 51-53% (empirical distribution costs). This means that except for the feed cost, certain items of processing have variable costs or mixed character. And therefore, for further analysis cost is needed to further diagnose costs and the variable costs in addition to the cost of the rank and some of the other items of the processing costs.

The validity of Benford's law has been demonstrated on the file of individual types of costs. The likelihood of errors in the data field of the cost has not been confirmed.

Table 2 Validity of Benford's Law

Number	1	2	3	4	5	6	7	8	9
Types of costs - detected data	30,232	18,259	11,953	9,302	7,976	6,977	5,874	5,101	4,326
Benford's law	30,103	17,609	12,494	9,691	7,918	6,695	5,799	5,115	4,576

This law is suitable for use in the detection of errors in large files metallurgical companies and metallurgical corporations. Financial analysts may also use this law when analyzing the data of enterprises in mergers and acquisitions. The main motive for the implementation of the merger is the optimization of the cost.

CONCLUSION

In conclusion it can be said that the mathematical apparatus and standard software products enable significantly objectify basis for management decisions in business practice but the problem is the availability and comparability especially of relevant data for their application. At this time we can use spreadsheet programs such as windows MS EXCEL for most mathematic statistic calculations.

Tests based on statistical principles can be used for the analysis of almost all accounting cases. Deviations can point to the likelihood of random or systematic errors in the accounts. Such an integrated method, then, can become a part of the regular controls of the accuracy of economic and accounting data, carried out by the internal auditors the financial authorities. In some EU countries, for example in Austria, this way of test is also implemented by tax authorities. In the United States, evidence for the detection of falsified data based on Benford's law has been accepted in criminal cases on the federal, state, and local levels [7,11] .

Whether we choose already being used new or traditional approaches to monitoring, control and evaluation of costs using economic and mathematical methods, the needs of current metallurgical companies must be

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