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Measurement and control of the technological process by means of the analysis of its efficiency.

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If a company wants to control technological processes it should take into consideration as well material, technological as quality aspects. Value which allows to define the influence of changes on a process is efficiency. Determination of efficiency shows how the implemented innovations influenced the final shape of a product, which a company manufactured as a result of the process which is being analysed.

1. INTRODUCTION.

For a company to measure efficiency is a quite big problem , because there are no strict rules , which could help to evaluate it. There is a lot of measures, indicator. Although companies often create their own dependencies, which allow them to determine the value of efficiency . It also makes it possible to control the way of managing, and efficiency in case of technological processes it allows to control and improve it. [1]

That is why the main task of an enterprise should be the control of technological process and further also measurement of efficiency, which is a determinant of activities of enterprises which are managed by quality.

In the process of such an analysis the most often used are such dimensions like: technological efficiency index, as well as material wear and working indicator. Systematic researches allow to introduce the corrective and preventive actions in an effective way.

The accepted index of efficiency and data of its calculation are normally obtained depending on the kind of the analysed process. When creating a model of efficiency analysis we should choose the most optimal way to present it from the enterprises point of view. That will allow to control and to improve it continuously.

An approach to the efficiency measurement in a company is not always the same and uniform. In this moment usually appears the problem of its comparison on the inter-company area. It is mostly caused by the efficiency index, which is related to quality and is a not standardized dimension. Reason of this fact is a.o. activity of companies on difference levels. From this levels point of view the analysis of efficiency of its activities and processes is carried out.

If we want to carry out a reliable analysis of efficiency of technological process, we should subordinate its activities to the technical efficiency and to the design of the technological process. [2,3,4]

2. EFFICIENCY OF A TECHNOLOGICAL PROCESS.

During the analysis of efficiency the basic term is technological efficiency (it is connected with processes of manufacture and is evaluated from the main technologist (process engineer) point of view). It should be a meaningful element when estimating the activity of a company. [5,6,10]

When describing the efficiency phenomenon of a given technological process first of all we should start by finding an answer to the question: what does exactly the technological process is and what we mean when we say technological process. [8,11]. Generally we can say, that within a technological process succeed changes of shapes, physic and chemical properties, exteriors of the manufactured material or persistent change of mutual position of individual parts which constitute the produced goods, i.e. assembly of components and products. This changes can be introduced by interaction of tools or in consequences of energy influence in any form (electric, light energy)[12].

Basing on this fact we can conclude, that technological efficiency depends on many technical parameters. Such parameters are e.g. reliability, durability, adequacy, maintainability, readiness and possibility of being repaired.[13]

Basic term is the average time of using the technical object. We estimate the reliability in two stages. First we establish the formula, which determines the reliability of an object on the basis of data of its composed elements. In the second lap follows accumulation of informations , which will allow to check the established formula on the basis of experimental data. Usually this data are not undoubted and that is why they are characterized as the random variables. In order to avoid such situation a lot of companies usually use nominal data and at the same time determine the limits of acceptable differences. Only the calculation of reliability amounts to providing the data into the established in the firs stage formula in order to obtain the final result.[14]

Reliability measure of a technical object is usually the total time of its exploitation, which depends not only on the technical characteristics of an object, but also on the condition of its operation. We estimate durability of a unit also with the aid of the quantity of work, which is already done and the number of job cycles or mass of the product.

Adequacy of technical object is a parameter , which can be determined on the basis of experimental data which are provided by tests and their use in practice . Very often an object can be destinated to many kinds of activities, which require also efficiency. That is why we can treat the adequacy as a function that characterizes the probability of carrying out all tasks with the required level of efficiency[5]

Maintainability is a meaningful parameter of efficiency, which directly influences the requirements that are connected with qualifications and quality of service skill and maintenance man- hour, which is required by the use of an object.[9]

Practical evaluation of efficiency of technological objects requires also determination of their readiness to fulfill tasks. This readiness is evaluated with reference to the given calendar period. To estimate it successful we will need data, which determine the average using and repairing time of the objects. It should not be difficult to obtain such data, but very often it can be on purpose to pass over e.g. stoppages caused not by damage to an object but by the lack of necessity of use it.[14]

The possibility to repair an object characterizes the level of difficulties occurring during repair of a damaged object. It also depends on structural properties of component elements, their accessibility and possibility of localization of the damages. In this meaning possibility to repair an object is something adequate to repairs, so it is not characterized by fully average

time needed for repair, which is used as agreed in the moment of its determination. Estimation of possibility to repair an object relies on determination of the average time needed for repairs and their costs.

Technological process consists of operations e.g. in a typical process of decrease processing we can identify following operations [7]:

- Initial operations
- Performance of processing base
- Operations of rough and shaping processing
- Operations of thermal and thermal-chemical processing
- Operations of finishing processing
- Operations of quality control

For each of the mentioned operations we can identify efficiency. We can do this using the dependence [10,19]:

$$E_{oi} = \frac{P_d}{L_p} \cdot 100,$$

Where:
E_o – working efficiency;
P_d – number of good products;
L_p – total number of products,
i - number of the operation

The results of efficiency which we will get from particular operations will allow us to determine the efficiency of the whole process. We calculate it using the formula [9]:

$$E_{pt} = \frac{\sum_{n=1..i} E_{oi}}{n} \cdot 100,$$

Where:
E_{pt} - efficiency of the technological process
E_o - efficiency of single operations
n - number of operations in a process
i - number of operations

Very meaningful indicator , which is very closely connected with the technological efficiency is the working indicator. It allows to define to what extent the hours already paid to the employees were worked by them out. If this index is equal to 1, that means that not a single minute was paid. The working indicator can be calculated when using the formula [16]:

$$W_p = \frac{E_{cp}}{R},$$

where:
W_p - working indicator
E_{cp} - effective working time (without the stoppage hours)
R- full man – hours (man- hours till payment).

It should be mentioned, that it is really hard to obtain the working indicator which is equal to one, because it should be considered, that the machines can be stopped due to technological reasons and other unforeseen circumstances such as e.g. damage to the tools can occur .

Other index, which is also connected with efficiency is the material wear indicator. It shows to what extent the material was manufactured into shavings. We calculate it from the formula [14]:

$$W_{zm} = \frac{C_p}{C_m},$$

where:
W_{zm} - index of material wear
C_p - real weight of the product [kg]
C_m - weight of the material[kg].

Systematic control of this indexes facilitates introduction of the necessary corrective and preventive actions, and as a result in order to increase the efficiency of the whole organization. [17].

3. SUMMARY

The idea of management in an enterprise should be related to efficiency of the technological process consisted of particular operations. Analysis of the efficiency of individual operations is useful in the moment when we want to find the reason of decrease in the total value of total efficiency of the technological process. In very easy way we can find an operation , which should be controlled, analised and changed in order to obtain the expected quality. Quality which is compatible with the customer requirements, with the aims of a company. Knowledge about the efficiency of the individual operations connected with the know – how needed to their improvement is a meaningful determinant of the value of an enterprise.

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