MONITORING AND CONTROL OF EFFICIENCY IMPROVEMENT OF METALWORKING PROCESSES

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Abstract

Globalization and strong competition in the market cause that enterprises have to achieve competition advantage. They try to offer products with higher quality, with lower price or with higher level of service. Therefore, a strong pressure to improve an efficiency of processes is observed, which demands permanent and systematic monitoring and control of a level of the process efficiency. In the paper the method of measurement efficiency of metalworking processes is proposed. It relies on analysis of specially made a set of indicators which assess the most significant aspects of the metalworking processes. This method helps to monitor and control of metalworking processes efficiency through analyzing target and actual value of indicators and comparison them. Based on this method it is possible to achieve the planned level of metalworking process efficiency in planned time, what guarantees effectively process improvement.

Keywords: key performance indicators (KPI's), metalworking process efficiency, process improvement

1. INTRODUCTION

As an effect of globalization is very strong competition in the market. Metallurgical enterprises have to achieve a competition advantage to survive and develop through offer higher quality products, lower prices or higher level of service in compare to competition. In practice this means that management should be transformed in a flexible and highly adaptive system in which make changes, measurement of performance, speed, noticing and correcting errors, reduce costs and deadlines become significant. The key elements of enterprise management are: customers, innovation management, knowledge and competence. Enterprises use many simulation methods in production [7], [10] and different methods to assessment production and apply innovations [1], [3], [5], [11], [12], [8]. Modern companies focus their mind on processes as well. Continuous improvement of all realized processes in the organization is now necessary. One of the most important tasks of contemporary enterprise is to streamline processes and rapid response to emerging opportunities and threats generated by the turbulent environment. Therefore, it is observed a strong pressure to improve of metalworking processes. The enterprises need a measurement system which helps them to assess the efficiency of processes.

Nowadays Business Process Management (BPM) is very often used in enterprises and is defined as the activity of optimizing the structure of the organization components due to their impact on the value creation of the final effect of separate processes. Process approach stems from the need to seek new sources of growth in the efficiency of the company. It is expected very high adaptability of enterprises through rapid adaptation of processes to the expectations of individual customers [15]. Enterprises constantly try to increase its operating efficiency and optimize the use of resources [9]. Dynamically developing the Performance Management (PM) concept that focuses on providing workers about necessary information for the effective

performance of their duties. It covers areas related to planning, measurement and evaluation of the effectiveness of the organization. The main purpose of Performance Management is the integration of all financial and operational data, ensuring their quality, reliability and availability. PM aspires to maximize participation of elements within the organization that add value and minimize the share of inefficient operations [14], [13].

In the paper the method of measurement efficiency of metalworking processes is proposed. It relies on analysis of specially made a set of indicators which assess the most significant aspects of the metalworking processes. This method helps to monitor and control of metalworking processes efficiency through analyzing target and actual value of indicators and comparison them. Based on this method it is possible to achieve the planned level of metalworking processes efficiency in planned time, what allows effectively process improvement.

2. THE SYSTEM OF MONITORING AND CONTROL OF METALWORKING PROCESS EFFICIENCY

According to the ISO 9000:2000 standard, efficiency is “the relation between results achieved (outputs) and resources used (inputs)”. The efficiency of a process means to achieve more or getting better results (outputs) with the same or fewer resources (inputs) [17].

Effective monitoring and control the efficiency of metallurgical processes should be based on well-prepared a measurement system. The company must carefully analyze the current course of the implementation of the processes and determine what changes to improve efficiency and what they are expected to apply. There is the basis to develop a measurement system of the efficiency improvement of metallurgical processes.

The paper presents a new solution which is based on the concept of the Performance Management and includes elements of the philosophy of the Balanced Scorecard. It is a system for monitoring and control the efficiency of metallurgical processes, which consists of two closely related components. The first part is developing a system for measuring the effectiveness of metallurgical processes and the second part follows the actual monitoring and control efficiency level. By comparing the level of achievement of the targets values of planned measures, it is possible to increase the efficiency of processes at the planned level at a specified time.

The main result of the study is a proposal of the procedure, which allows an efficiency of metallurgical processes effective to be monitored and controlled. It consists of seven stages, which are shown in **Fig. 1**.

The *goals of an efficiency improvement* of metallurgical processes based on a details analysis of the flow of processes are determined in the first stage. The authors suggest analyzing a few perspectives, as follows:

- financial perspective,
- customer perspective,
- process organization perspective,
- length and growth perspective,
- environmental protection perspective [3], [4],
- safety, ergonomics and health of workers perspective.

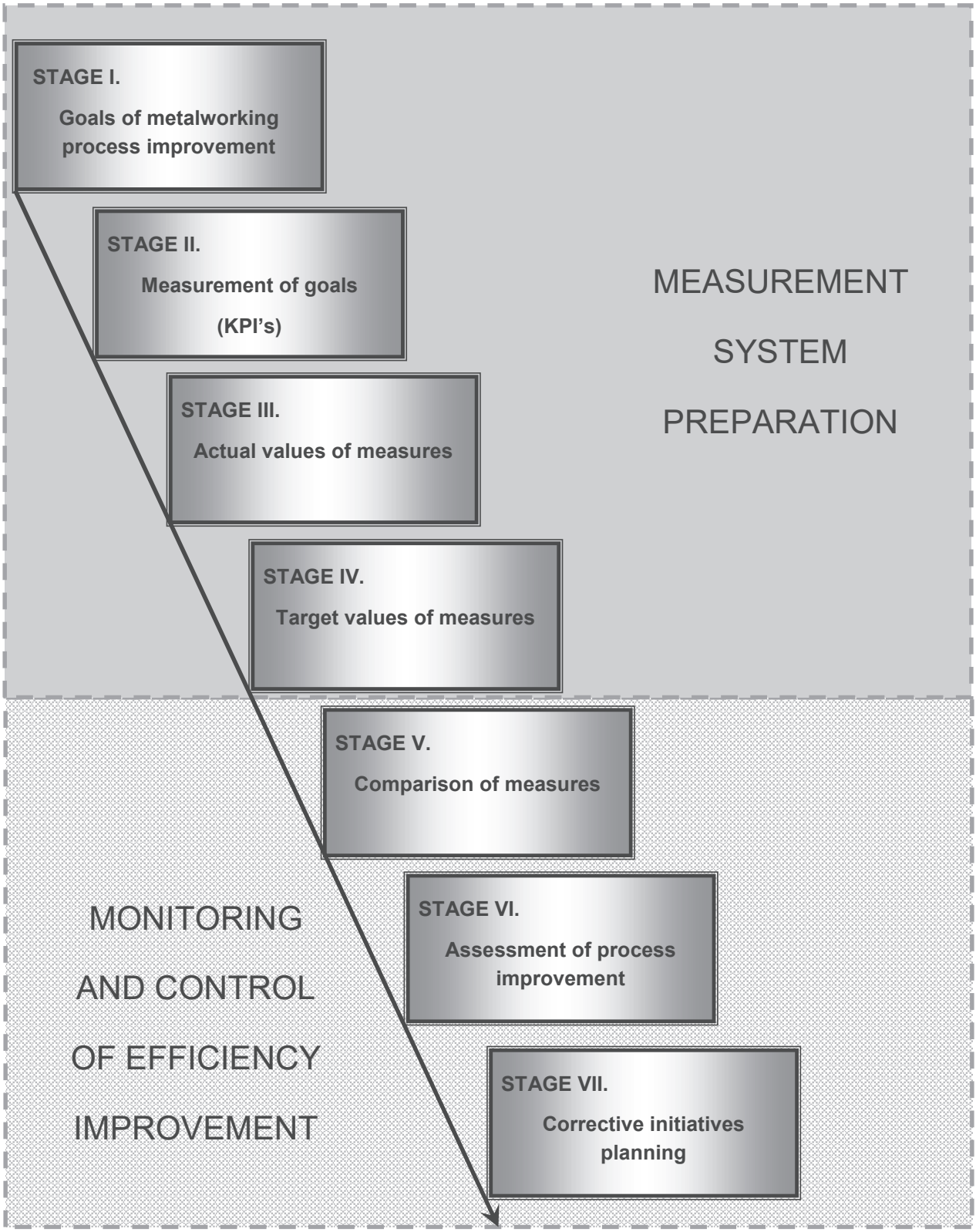

Fig. 1 Stages of the monitoring and control of the efficiency of metallurgical processes

According to the authors, a set of perspectives selected in this way allows the significant objectives for the various metallurgical processes to be identified. Then, based on specific objectives *measures* are developed (second stage), on the basis of which it will be possible to determine of the level of their implementation.

In the third stage *current values of individual measures*, which are the basis for determining the *target values* (fourth stage) are calculated. The target values are the expectations for the development of the individual measures. They should be identified very carefully, because this step can determine the success or failure of the proposed solution in many cases. It is not beneficial to plan too exorbitant values, nor too low. The values impossible to reach may play an unmotivating role. Unambitious establish a target value may, however, causes the achievement of the objectives will run at a much slower or not the company will use to its full potential.

The first four stages are included in the phase of preparing the effectiveness measurement system of metallurgical processes. The next three stages belong to the phase of an efficiency monitor and control of metallurgical processes.

The fifth step involves *comparing the actual values with the target values*. On this basis, the level of achievement of the objectives are assessed (sixth stage) which was identified in the first stage. Each goal is specified in the first stage must have a time limit for completion of targets values, on the basis of which its realization is measured. This time limit determines the dynamics of achieving targets values and that on this basis shall assess whether the implementation of the objectives is consistent with the expected dynamics or not.

If the level of the objective is too low, *the reasons for this state of affairs* should be examined and *plan of corrective actions* that would have changed. Stage seven is very important in the prevailing conditions, because of the changes in the environment occur so quickly that very often revise and update existing plans is needed.

3. MEASUREMENT OF METALWORKING PROCESS EFFICIENCY

In the second stage of the present procedure measures for the planned objectives are determined. Examples of the most commonly used measures are presented in **Table 1**.

The measures presented in the **Table 1** were determined based on the most common areas of evaluation of metallurgical processes such as [13]:

- quality of manufactured elements of products (improvement quality of manufactured elements, defects reduction, correction costs reduction, quantity of complaints reduction, etc.),
- costs (elimination the redundant processes, improvement of workers' productivity, etc.),
- timeliness (shorten time of anticipation, shorten time unplanned stoppages, etc.),
- assets utilization (high supply reduction, overproduction reduction, during production loss reduction, etc.) - (see [16], [6]).

At this stage, it should be remembered that the analysis cannot last too long, so the most important measures that will be monitored and controlled should be chosen. Also important is the frequency of the checks. Each measure should have a specific frequency control, for example, every month, every week, every day, every two hours, etc.

Table 1 Proposed example of indicators for assessment of metalworking processes [13]

Area of assessment	Goal	Indicator
Quality	Reduction in defects	Quantity elements manufactured correctly (without defects and rejections) / total orders
Quality	Improvement quality of manufactured elements	Quantity of measurement of finished products / total finished products
Costs	Improvement of workers performance productivity	Quantity of manufactured elements on the one workstation / quantity of man-hours
Timeliness	Shorten time unplanned stoppages	Time of unplanned stoppages / Total working time
Assets utilization	High supply reduction	Inventory turnover of supply
Assets utilization	Increase NCN machine utilization	Capacity utilization NCN machine

CONCLUSIONS

The presented system of efficiency monitoring and control of metallurgical processes includes the procedure which consists of two phases. The first phase is developed the measurement system, and the second phase is monitored and controlled level of organizational goals to improve the efficiency of metallurgical processes.

Properly identified goals and selected measures of the level of their implementation contribute to the systematic monitoring and control of enterprise effectiveness of the metallurgical processes. The proposed procedure thus allows for an effective improvement in the efficiency of metallurgical processes in a strictly scheduled time.

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