

**COMMENT**Worldwide Congress on  
Materials and Manufacturing  
Engineering and Technology16<sup>th</sup> - 19<sup>th</sup> May 2005  
Gliwice-Wiśła, PolandCOMMITTEE OF MATERIALS SCIENCE OF THE POLISH ACADEMY OF SCIENCES, KATOWICE, POLAND  
INSTITUTE OF ENGINEERING MATERIALS AND BIOMATERIALS OF THE SILESIA UNIVERSITY  
OF TECHNOLOGY, GLIWICE, POLAND  
ASSOCIATION OF THE ALUMNI OF THE SILESIA UNIVERSITY OF TECHNOLOGY, MATERIALS  
ENGINEERING CIRCLE, GLIWICE, POLAND**13<sup>th</sup> INTERNATIONAL SCIENTIFIC CONFERENCE  
ON ACHIEVEMENTS IN MECHANICAL AND MATERIALS ENGINEERING**

## Chosen aspects of evaluation of productive processes on the example of productive chains of sections type V29

M. Roszak<sup>a</sup> and St. Tkaczyk<sup>b</sup>

<sup>a</sup> Division of Quality Management, Institute of Engineering Materials and Biomaterials, Silesian University of Technology, Konarskiego St. 18a, 44-100 Gliwice, Poland, email: marek.roszak@polsl.pl

<sup>b</sup> Polish Packaging Research and Development Centre, COBRO, Konstancińska 11, 02-942 Warszawa, Poland

**Abstract:** In the paper the problems referring to the chosen aspects of evaluation of the productive chains were presented. The analyses and investigations concerning evaluation of the productive processes of sections type V29 in the real industrial conditions were described. Made analyses and evaluation of the productive chains was based on investigations dealing with time, costs and lacks which derives from applied technological and organizational system realized for the investigated productive chains. The purpose of the study was to define the influence of applied technological and organizational system on received effectivity of the realized processes including determined value added in the examined processes and possibility to receive competitive majority on the market. The detailed technical and economic analysis was based on the suggested system of evaluation of the productive chains. This system comprises application of measurement of costs using the method Active Based Costing (ABC), timing of the operation model of value added in the material productive processes, multi-criterion analysis and applying chosen economic coefficients.

**Keywords:** Productive chain, Evaluation of the productive processes, Value analysis, Quality, cost,

### 1. INTRODUCTION

The present problems of evaluation and monitoring of productive processes become one of the most important links in undertaking the management decisions so from point of view of economics of production as of practical technology [1-6]. The demarcation of technical and economic sciences on stage of undertaking the right decisions concerning evaluation and monitoring of productive processes, becomes incorrect and it in inadequate manner - regarding values carried in by both sciences - limits obtained results in driven analyses. This is why it is so important to use technological knowledge in economic aspect to classifying, evaluation and projecting of productive processes. One of the most important aspects describing present processes – as it was show in numerous investigations – is the quality of the product, which is the result of the quality of the planned and realized productive chain [1,4,7-9].

## 2. EXPERIMENTAL PROCEDURE

The aim of the study was an evaluation of the chosen productive processes of the metallurgic industry with regard to technological and organizational connections, based on accepted methods of investigations. The study was done in chosen national firms of metallurgic industry possessing Quality Management System.

The following methods were used: Pareto-Lorenz's analysis (ABC) – analysis of costs of lacks; econometric coefficients; timing of technological and organizational operations; model of value added in material productive processes; multi-criterion analysis of evaluation of productive processes; examination of mechanical and technological parameters applied in evaluation of quality of chosen processes.

The productive chains of sections type V29 were analysed in the integrated ironworks "X" and cooperating ironworks "Y" and "Z". The subject of the investigations was the productive process of the sections type V29, which is used in mining. Sections V29 are produced from steel: 34 GJ (PN-89/H-840023/05) in the firm "X"; 31 Mn4 (DIN 21544) in the firm "Z". Steel 31 Mn4 is a German equivalent of Polish steel 34 GJ.

## 3. DISCUSSION OF INVESTIGATION RESULTS

The product had the same technical parameters in both analysed productive chains (PN - H 993221 – 1). The analysed productive chains of sections type V29 significantly differ from each other. The process realized in firm "X" begins from producing raw stuff in blast-furnace process, and further is realized through converter process, outside blast-furnace tooling and continuous pouring off steel. In the firm "Y" at the beginning is scrap-metal, and the process begins from smelting of steel in the electric arched stove and finishes with continuous pouring off steel, cutting and marking. Further process of roll forming is realized in the firm "Z".

Described in the study model of evaluation of value added in material productive processes was based on division of operations on these which add the value and those which do not add the value. Obtained values of costs were defined on the basis of analysis of costs using the method: Active Based Costing. The results are presented in the Table 1 (analysis of productive processes of sections type V29).

Table 1.

Costs of production and value added for productive chains of sections type V29

| Type of costs              | Firm           |                |
|----------------------------|----------------|----------------|
|                            | X              | Y and Z        |
| Production                 | 48,35 %        | 63,17 %        |
| Storing and transportation | 2,63 %         | 4,6 %          |
| Control                    | 3,12 %         | 6,5 %          |
| Lacks                      | 0,44 %         | 2,15 %         |
| <b>Costs together</b>      | <b>54,54 %</b> | <b>76,42 %</b> |
| <b>Value added</b>         | <b>45,46 %</b> | <b>23,58 %</b> |
| <b>Price</b>               | <b>100 %</b>   | <b>100 %</b>   |

Made cost-time analysis of chosen productive chains of sections type V29 allows to determine exactly the parameters of productions concerning obtained time and cost effectivity (table2).

Table 2.

Time effectivity ( $E_h$ ) and cost effectivity ( $E_k$ ) of productive processes of sections type V29

| Effectivity | X       | Y and Z |
|-------------|---------|---------|
| $E_k$       | 89,4 %  | 84,50 % |
| $E_h$       | 79,65 % | 75,50 % |

In the purpose of better evaluation of productive processes, comparison of obtained values of lacks in analysed productive processes was done, which are generated by technology and means of management. On the basis of analysis of lacks, costs of lacks and their participation in the process of creation of value added were described.

In the table 3 quantity of lacks is presented. The obtained quantities of lacks derive from qualitative analyses made in firms and comprise data of one year (2002).

Table 3.

Level of lacks in the examined processes of the sections type V29 (in percent)

| Place<br>of formation of lacks | Firm   |        |        |
|--------------------------------|--------|--------|--------|
|                                | X      | Y      | Z      |
| Steel (melt)                   | -      | 0,23 % | -      |
| Section                        | 0,89 % | -      | 3,08 % |

The analysis of lacks reveal that the greatest participation of lacks in the realized process was in the firm "Z" for the process of roll forming.

Successively, an evaluation of productive chains of sections type V29 was made using a coefficient of productiveness according to value added –  $P_{AV}$  (1) [10,11], which was defined as the relation of value added to the time of production  $t_w$ :

$$P_{AV} = \frac{C - K}{t_w} \quad (1)$$

where: C – price; K – costs of production.

Obtained values of coefficient of productiveness according to value added for examined productive chains are presented on the illustration 1.

Value of productiveness for the process realized in the firm "X" is presently much more greater, what means that applying technology and organization of the process allow to more effective organization of the production and achieving more profit.

The ideal processes (lacks=0, elimination of operations not bringing value) indicate at significant increase in productiveness of the analysed processes, but for process realized in the productive chain in firms "Z" and "Y" it grows over 100%.

Made investigations and analyses concerning processes of forming of sections type V29 permit to show that to the factors significantly influencing economical results belong so technology as applied manner of realization of processes, and also human factor which stimulates obtained values of lacks. The own study indicate that applied technologies are not fully used from regard on instability or inefficient organizational system.

#### 4. SUMMARY

Presented in the paper means of evaluation is one of the methods. The meaning of created in the productive processes value was shown as one of the main economic coefficients which allows to evaluate the productive processes.

Suggested in the paper means of evaluation of the processes with use of some defined econometric coefficients refers to three main parameters: time, costs and quality, and is simple and univocal.

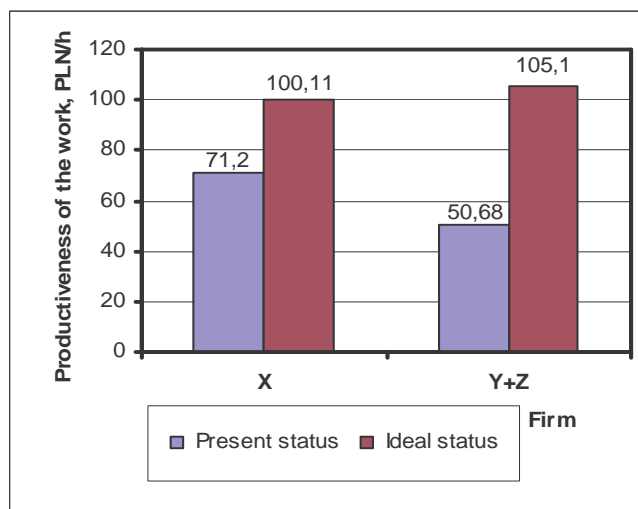


Figure 1. Values of productiveness of the work according to value added for the examined processes

Such look at the productive processes allows to assess productiveness of realized processes through created in them value and to seek for ways of building the success.

## REFERENCES

1. Koch T., Zadrożny R.: Metody ciągłego doskonalenia procesów produkcyjnych, Mat. Konf. Procesowe Zarządzanie Jakością, Wyd. Pol. Wrocławskiej, 1999, 145
2. Koch J.: Droga do konkurencyjności przedsiębiorstw, Prace Naukowe Inst. Tech. Maszyn i Automatykacji, Pol. Wrocławska, Nr 67, Seria: Konferencje 29, Automatykacja Produkcji '97, Innowacje w technice i zarządzaniu, Tom I, Oficyna Wyd. Pol. Wrocławskiej, Wrocław, 1997
3. Lowe P.: Zarządzanie technologią. Możliwości poznawcze i szanse, Śląsk, Katowice, 1999
4. Porter M.E.: Strategie konkurencyjne, PWE, Warszawa, 1992
5. Roszak M., Szewieczek D., Tkaczyk St.: Manufacturing technology and value added, Mat. 10th International Scientific Conference: Achievements in Mechanical and Materials Engineering, Gliwice - Zakopane, 2003, 759
6. Roszak M.: Evaluation of selected productive processes based on the value analysis, Doctorate, Institute of Engineering Materials and Biomaterials, Silesian University of Technology, Gliwice, 2004
7. Banaszak Z. (red.): Zarządzanie operacjami, Wyd. Pol. Zielonogórskiej, Zielona Góra, 1997
8. Góralczyk A.: Produktywność a koszty jakości procesu – przegląd zagadnień, Problemy Jakości, 12, 1997, 32
9. Tkaczyk St., Roszak M.: Analiza procesu technologicznego w oparciu o kryterium wartości dodanej, Mat. 10th International Scientific Conference: Achievements in Mechanical and Materials Engineering, Gliwice - Zakopane, 2002, 575
10. Andrade M.C., Pessanho Filho R.C., Espozel A.M., Maia L.O.A., Qassim R.Y.: Activity – based costing for production learning, Int. Journal of Production Economics, 62, 1999, 175-18
11. Góralczyk A.: Ulepszanie procesów biznesowych (nieprodukcyjnych), Problemy jakości, 11, 1997, 27