12th INTERNATIONAL SCIENTIFIC CONFERENCE
ACHIEVEMENTS IN MECHANICAL & MATERIALS ENGINEERING

Manufacturing technology and value added

M. Roszak, D. Szewieczek, S. Tkaczyk

Division of Quality Management, Institute of Engineering Materials and Biomaterials,
Silesian University of Technology of Gliwice
ul. Konarskiego 18a, 44-100 Gliwice, Poland

In the paper there were presented the problems of forming the competitive position of the factory in the function of manufacturing technology. In the study the evaluation of manufacturing technology of cog-wheels was done in the aim of describing value added.

1. INTRODUCTION.

Every organization also manufactories are based on three basic pillars: processes – technology – people. They permit on realization and satisfaction of needs formed by market. Manufactories are based on efficient management of above mentioned pillars and utilization of material, energetistic, capital and human supplies [6,13,15].

Management of manufactories relies on seeking and defining the correlation between supplies, formating effectivity undertaken in the firm activities and realized of targets. The formation of effectivity in manufactory firstly is based on the manner of realization of processes - measured for instance by income. It is dependent on people and used by them technology. It characterizes efficiency of processes conducted in firms measured most often with costs [1,3-5,14,15,19].

The productive processes belong to basic strategic activities realized in the firms. In the realization of them it is important to select suitable techniques of production, which will warrant success in function of efficiency and quality of realized processes. One should diagnose manners of management with production and technology. It will permit on choice of the most economically and qualitatively effective processes. Productive processes differ between each other within the production of the same article in following aspects: technology of production, means of production, forms of organization of production, methods of cooperation [1,6,11,16].

Defining of productive processes is taken on the ground of expectations and needs of customers, which are exchanged in the productive process on requirements. Productive processes should be analysed as dynamic systems [5,6].

Technology of production in the productive process is a base to creation of value added during its realization – within the firms or the whole productive chain. Maximization of values added of conducted productive processes is an important element of formation of competitive position of the firm, it permits to increase the effectivity of production [10,11,12,20]. Nowadays the analysis of value added is a tool in the modern management of

production. It permits on qualification of the most economic methods and means of production. Its aim is to diminish the costs of production, and also receive optimum advantages from article [10,21].

To the basic activities of management of production belong: shortening time of productve process, reduction of participation of the capital and increasing the velocity of the capital. The present productive strategies are based on three main parameters: time, costs and productive abilities of the firm. With these parameters one can describe every technological process. Effectivity of realization of production in all productive chain relies on assurance suitable efficiencies of organization and management in such matters as: circulation of information, quality of technology, formation of deliveries and reserves. For so accepted aims, firms have to produce in accordance with following rules [2,6,8,21]: suitable quantity of article, in definite time (for instance using JIT); definite kind and quality, (for instance using TQM); in the most economic manner,(for instance initiating an approach of process).

One can reach a considerable level of effectivity of realized productive processes through increased quality of articles and processes, diminishing the stores and reduction of costs from regard on accepted technology [11].

Most interesting area of formation of productive processes is creature of technological operation forming productive process [10, 15, 16].

To basic sources of obtaining competitive superiorities belong [2,5,12]:
- „manufactoring in world class" of products with possibility of quick adaptations of size and structure of supply - to size and structures of demand,
- velocity of creation and development of new and improved products on total market.

To factors of success belong [5,12,16]:
- organization of business processes in all chain of creation of value,
- orientation of the firm on needs of customers,
- Structure of information system and methods of profiting from information, and others.

According to Thurow, present competitive superiority of firms is a result of usage new methods of realization of processes, and not only of technology of production [15]. Norton and Kaplan speak about multispeciality of organization in era of information. Firms wanting to be competitive have to create strong relationships with customers and tradesmen, to raise quality of articles, to increase innovation of analysises of processes in aspect of costs of production and creation of value in processes, consolidation of productive chains [10,17,18, 20,21].

To determinants of competitive features of firm belong [7,8,12,15,19]:
- Technological and qualitative level of product
- Level of technology and of machine - park,
- Competences of techno-engineering and marketing personnel
- Participation of financial surpluses in enlarging technological and marketing possibilities of the firm.

Adapting the firms to all the time changing environment and changing the needs of consumers, is a condition of their survival on the market. Present firms introduce changes more and more often, and their range is more and more greater. Introducing of changes and adapting to environments becomes with the norm of activity of modern organization. Every organizational problem will demand proper solution in every circumstances and realised in proper time, range and rate.

Production of article of required qualities and at the lowest costs is possible, when every activity in productive process executed is correctly in a lasted manner, independently from disturbances. To reach it, inspection of quality has to be connected with the same process, and its aim should be prevention from formation of defects [5,18].

The duty of management of firm is to tend to improve the productive processes, realizing in this manner a postulate about the need of incessant improving of process.

More and more often appointed postulate for modern management of organization is creation of chains of integration of firms in productive processes. This idea has a lot of advocates seing in running nowadays processes of globalization and formed ideas of creation of virtual firms - possibility of dynamic development of firm on market, as also forming its stability in relation to competitors. One of the examples of creation of chains of processes, descending from logistics is idea of management of chain of deliveries - Supply Chain Management (SCM) [13,17,18,21].

2. ANALYSIS OF VALUE ADDED ON EXAMPLE OF PROCESSES OF PRODUCTION OF COG-WHEELS

In the study the analysis of chosen methods of production of cog –wheels was done in the aspect of the cost and temporary effectivity in realized productive chains. Production of cog - wheels can be made in following methods: tooling with machine cutting; plastic tooling, founding. The research of productive processes of cog -wheels were realized in two firms „X" and „Y". These firms possess initiated and certificated Systems of Management with Quality based on the norm ISO 9001: 2000. Firms are similar in respect of size and number of employed workers.

During the research an analysis of processes in aspect of quantity of lacks during realization was made. Analysed processes of production of cog -wheels became described by technological and organizational operations, to begin from purchase of material, and having finished on final inspection, with regard of transportation and storing. It was made a detailed analysis of operations and interventions, which do not bring value added to finished article in examined processes.

In aim of realization of cost-time analysis unit times of individual operations were done by means of timing and on the ground of information originating from technological records of both firms about analysed productive processes. Cost of man-hour in each firms carries out: in firm „X" – 80 zł/h; in firm „Y" – 70 zł/h. According to technological specification of the firms it was accepted, that cost of entrance - material to analysed processes in firm „X" carries out – 5, 0 zloty, in firm „Y" - 4, 41 zloty. In support for analysis of value added one counted costs of each operation and one executed analysises of processes in respect of acts, which do not bring value added to finished article. To acts, which do not bring value added to finished article belong: transportation, storing, interoperative inspection, final inspection.

Made analysis of processes of cog -wheels production delivered data given below. In firm „X" technological process of cog -wheels driven was from material in form of a rod from steel 45H, and in firm „Y" – from forging from steel 40HM. Requirements for final product in the process in the firm "X" and "Y": number of teeth "X"- 30, "Y" – 51, module "X", "Y" – M=5, angle of buttress "X" and "Y" α = 20°, heith of tooth "X", "Y" y=1, diameter "X" dp = 150, "Y" = 263, hardness "X" 32-38 HRC, "Y" 54-58 HRC. Choice of material has a deciding meaning in the duration of the process. Total cost of producing of one cog -wheel in firm „X" carries out 217,62 zloty and lasts 2,66 h, in firm „Y" values carry out as follows:

200,48 zloty and 2,80 h. Sizes of parts realized in analysed processes of production are nearing. In the teable 1 it is presented the destructure of egzamined processes.

Table 1. Structure of egzamined processes

OPERATIONS	FIRM „X"	FIRM „Y"
	quantity	
Storing	2	2
Transportation	4	8
Inspection	5	6
	26	29

In table 2 there are presented costs and time of duration of operation which do not bring value added to finished product for analysed processes. Obtainment of considerable temporary and cost values of operations not bringing values added to finished product is not profitable for obtained results in effectivity of processes.

Table 2. List of operations not bringing of profit to finished article

Operations not bringing values to finished article	Firm „X"		Firm „Y"	
	Cost [pln]	Time [h]	Cost [pln]	Time [h]
Storing	34,40	0,430	23,52	0,336
Transportation	18,24	0,228	7,84	0,112
Inspection	52,00	0,650	33,60	0,480
Together	104,64	1,308	64,96	0,928

On base of gathered data one executed calculations of cost effectivity Ek and temporary effectivity Eh for analysed processes of production of cog -wheels. List of obtained results of cost and temporary effectivity for analysed productive processes is given in Table 3.

Table 3: Temporary and cost effectivity for selected processes of production of cog -wheels realized in examined firms

Effectivity	Firm „X	Firm „Y"
E_k	51,91 %	67,59 %
E_h	50,76 %	66,86 %

On the fig.1 it is shown graph of value added for egzamined procesess. Value added is described as arelation of value (market price of product) to cost of the given operation.. Value added is growing only in the operations bringing value.

3. SUMMARY

In present work cost-time analysis was made for realized in fact productive processes of the same product, described with similar characterizations. Presented in the text analysis of processes of production permits on defining places of formations of costs, delays and errors influencing unfavourably on obtained in given process of effectivity measured value: with costs and time.

On base of made analysis one can ascertain that: obtained results of temporary and cost effectivity of the process realized in firm „X" are smaller about 15% than obtained results for process realized in firm „Y". Obtained times of realization of product in examined productive processes are comparable. Difference in costs of production between firms are about 8, 5%.
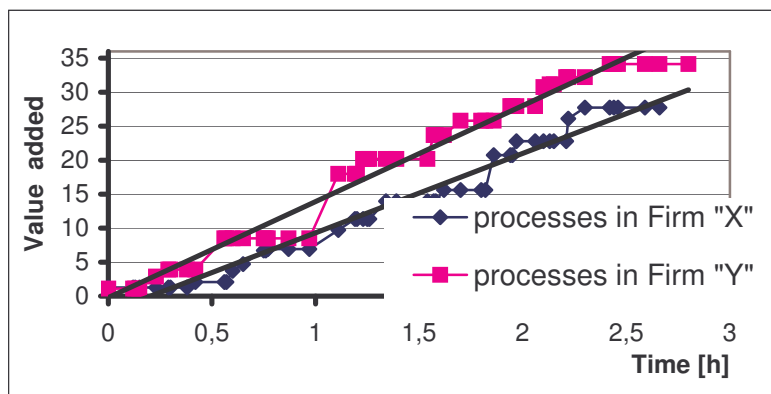
Fig. 1 Value added in the processes of analasis

Obtained results of temporary and cost effectivity in distinct manner show that used technological-organizational solutions of realization of productive process in firm „Y" is more effective.

Profit from driven processes in firm „Y" is nearly 13% greater than in firm „X". Table 4 shows detailed data relating production of cog -wheels analysed in the study. In table 5 there are setted coefficients of efficiency, productivenesses, profitability, ekonomics obtained for investigated processes.

Table 4. List of composition elements needed to delimitations of coefficients given in table 5

Parameters	Firm „X"	Firm „Y"
Quantity of lacks	1700 szt.	5300 szt.
Size of production	110000 szt/rok	140000szt/rok
Price	390 zł.	395 zł
Cost	217,62 zł.	200,48 zł.
Total cost of production	23938200 zł.	28067200 zł.

Tabel 5. List of coefficients for analysed firms

Coefficient	Firm „X"	Firm „Y"
Efficiency	98,46 %	96,22 %
Profitability	44,20 %	49,24 %
Ekonomics	79,21 %	97,02 %
Productiveness	99,55 %	99,51 %

Type of used technology of production as it was showed in the research and manner of organization of process along the whole productive chain in decisive manner influence the level of quality of the ready product.

To the most important factors deciding about created values in the productive processes belong such factors as: kind and modernity of used technology, possessed machines and devices, level of qualifications of workers (for instance konw-how), as also manner of management of the process. On base of done analysis of selected productive processes one can ascertain, that in economic sphere planned and driven realization of productive processes according to obligatory in firm „Y" of technology of production brings to firm considerably greater value than used technology in firm „X".

Actually works are done over elaboration of general model permitting on univocal positioning of practical technology in respect of maximization of value added created along the productive chain. Improvement of efficiency of activity in the firm has to unite

technological dimension (categories of quantity, time and quality) with economic dimension (category of value) this is why research of solutions of estimation of used productive technologies is essential.

REFERENCES

1. Dobrzański L.A. (red.): Zasady doboru materiałów inżynierskich, WNT, Warszawa, 2001
2. Drucker P.: Zarządzanie w czasach burzliwych, Nowoczesność, Warszawa, 1995
3. Durlik I.: Inżynieria zarządzania, Cz.I: Strategia i projektowanie systemów produkcyjnych, Placet, Warszawa, 1998
4. Griffin R.W.: Podstawy zarządzania produkcją, Wrocław, 1992
5. Grudzewski W.M., Hejduk I.K.: Projektowanie systemów zarządzania, Difin, Warszawa, 2001
6. Ignatiuk S., Wojsznis B., Ignatiuk S.: Organizacja i zarządzanie procesami wytwórczymi, Wyd. Pol. Białostockiej, Białystok, 1997
7. Kapserek M.: Łańcuch dostaw jako narzędzie redukcji kosztów wytwarzania, Gospodarka Materiałowa i Logistyka, 2/2001, 10
8. Koch T., Zadrożny R.: Metody ciągłego doskonalenia procesów produkcyjnych, Mat. Konf. Procesowe Zarządzanie Jakością, Wyd. Pol. Wrocławskiej, 1999, 145
9. Kucharczyk A.: Ekonomika i podstawy zarządzania w przedsiębiorstwie przemysłowym, Uczelniane Wyd. N-T, AGH, Kraków, 1999
10. Lisiecka K.: Rachunek kosztów procesu na przykładzie przedsiębiorstwa branży metalowej, Mat. Konf. Procesowe Zarządzanie Jakością, Wyd. Pol. Wrocławskiej, Wrocław, 1999, 93
11. Lowe P.: Zarządzanie technologią, Możliwości poznawcze i szanse, Wyd. Śląsk, Katowice, 1999
12. Martyniak Z.: Nowoczesne metody zarządzania produkcją, Kraków, 1996
13. Maternowska M.: Wytwarzanie w przyszłości, Ekonomika i Organizacja Przedsiębiorstw, 4/2001, 25
14. Penc J.: Kreowanie sukcesu firmy, Ekonomika i Organizacja Przedsiębiorstw, 7/2001, 13
15. Peppard J., Rowland P.: Re-engineering, Wyd. Gebethner&Ska, Warszawa, 1997
16. Sobolewski K.: Podstawy organizacji procesu produkcyjnego, Wyd. Pol. Koszalińskiej, Koszalin, 1997
17. Tkaczyk St., Roszak M.: Zarządzanie łańcuchem dostaw (SCM) jako strategia rozwoju współczesnej logistyki w ujęciu jakościowym, Mat. Międz. Konf. M3E'2000, Gliwice, 2000
18. Tkaczyk St., Roszak M.: Zarządzanie łańcuchem dostaw w ujęciu jakościowym, Mat. Międz. Konf. Zmieniające się przedsiębiorstwo w zmieniającej się politycznie Europie, Tom 4, Kraków, 2001, 819
19. Tkaczyk St.: Inżynieria jakości a inżynieria materiałowa, IOiZwP, ORGMASZ, Warszawa, 2001
20. Zarzecki D.: Rola ekonomicznej wartości dodanej (EVA) w wycenie przedsiębiorstw, Ekonomika i Organizacja Przedsiębiorstw, 8/2001,
21. Tkaczyk St., Roszak M.: Analiza procesu technologicznego w oparciu o kryterium wartości dodanej, Mat. 11 Międz. Konf. AMME'2002, Gliwice - Zakopane, 2002, 575