

PROCESS COST CALCULATION METHOD AS A TOOL FOR SUPPORTING PROCESS ORIENTED MANAGEMENT IN THE COMPANY

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Summary: The discussion about cost calculation of processes pursued in enterprise in the context of effective management of these processes has been carried out in the paper. Essence of process management and difficulties linked with measurement and improvement of processes have been described. Next the discussion has been carried out on imperfection of traditional methods of cost calculation. The cost calculation method based on Activity Based Costing has been proposed as a tool which enables precise processes cost determination together with its structure and consistently improvement of these processes. Advantages and difficulties connected with implementation the proposed method have been pointed out.

Keywords: process, activity, activity cost, process management, Activity Based Costing ABC, process improvement.

1. Introduction

Contemporary quality systems in organizations are generally based on the ISO 9000 guidelines. Rising number of enterprises all over the world prefer ISO 9001 certified suppliers and co-operators. Business contracts often are being preceded with the review of the quality manuals. Complying with requirements included in quality standards assures recipients of high capability of suppliers of products and services to fulfill quality requirements.

ISO 9000:2000 edition (2008 edition too) puts special emphasis on the process approach. That means the necessity of identifying processes in organization and managing them. As long as the identification of processes in organizations does not make great problems, in so far as describing appropriate measuring instruments often seems to be more troublesome, by means of which the analyzed processes are monitored and improved. Beyond sparse exceptions [1, 2], there is not equal number of surveys, which would contain examples of usage of systems of processes measurement in the process of production.

Large number of methods of processes analyzing and assessment is based on the process cost, so it is necessary to use up-to-date management accounting tools, including advanced cost calculation methods. Standing cost account, based on division and additional calculation methods, specifies only material cost, labour cost and overhead. Then, cost analysis is limited only to these cost areas [3].

Tendencies in the market economy development, such as keener competition, closer cooperation and global market, changes referring to technology and automation of production processes, increasing the range of products and shortening their life cycle, caused changes in the enterprises cost structure. Contemporary business is characterized by high share of indirect cost within production total cost. Moreover, that share shows

permanently an increasing trend. That is why traditional methods of cost calculation provide inexact information that contribute to make mistaken decision. More over, described tendencies require knowing exact values of all cost components related to manufacturing process, the total cost of manufactured products and, of course, the cost of particular processes in enterprise. Traditional cost calculation methods do not make it possible [3, 4].

Costs of processes are not recorded in the separate accounts in the traditional financial accountancy, that is why it should be carefully selected out of the other items passed in the system. According to A. Hamrol, that is why it is one of the main reasons that reliable estimation of quality assurance processes costs in Polish enterprises is not common [5]. This problem seems to touch other processes in organizations too. It is obvious that without precise cost information full description of effectiveness of the realized actions is impossible. That is why to put in practice the guidelines of the process approach by introducing processes measurement, for example based on the balanced scorecard, it is necessary to apply an appropriate method enabling to gain suitable cost data and its transformation into usable information from improvement of processes point of view.

2. Process oriented management

The change of the business environment entails the necessity of changing methods of management in present times. Contemporary conditions of enterprises functioning in turbulent surrounding, above all both intensifying competition and occurred changes dynamics, set new tasks in range of high quality products, increasing efficiency of business processes simultaneously aiming at decreasing the costs of production and shortening production cycles. As a result of such situation in enterprises is most often restructuring which is usually connected with dismissals, changes of organizational structures, legal status, implementation of expensive information system, asset sales, etc. But as the researches show, only 25- 30% enterprises assess that kind of short-term fixation brought positive results. Due to I. Durlík, traditional restructuring gradually allows to achieve technical and organizational progress in limits 5-10 percent annually, with successive revamping of organizational structures and management improvement. This improvement is most often connected with computerization and partial automation of management processes and production of processes created in traditional condition of information processing [6].

A chance for radical change manifesting itself first and foremost in better results, is precise analysis of processes appearing in organization, reorganization and continuous perfection. Great popularity in 90's gained Business Process Reengineering (BPR) which main guideline is to make radical changes of hierarchic organization structure into horizontal, based on processes not on functions [3, 6, 7].

Reengineering put an emphasis on breakage with the old rules of organization and designing all processes in every area of enterprise. We cannot focus only on technological processes. Such conception establishes redesigning of comprehensive processes i.e. concentrated both on internal and external customer service [6].

Radical changes are not registered in the TQM philosophy, which is based on the Kaizen continuous improvement principle. Such perceptible orientation of improvement of processes assembles also the series of ISO 9000:2000 and later standards [8]. According to these norms, the process approach is a "systematic identification and management of the processes employed within an organization and particularly the interactions between such

processes”, whereas a process is a “set of interrelated or interacting activities which transforms inputs into outputs” [8].

According to ISO 9001 standard, in order to implement and maintain a quality management system, the organization should [8]:

- 1) Identify the processes needed for the quality management system.
- 2) Determine the sequence and interaction of these processes.
- 3) Determine criteria and methods needed to ensure that both the operation and control of these processes are effective.
- 4) Ensure the availability of resources and information necessary to support the operation and monitoring of these processes.
- 5) Monitor measure and analyze these processes, and implement actions necessary to achieve planned results and continual improvement of these processes.

Adaptation to the process approach assumptions entails the necessity of changes in the organizational structures of enterprises. Most of the management systems in Polish enterprises are based on functional structures. The crucial disadvantage of these structures is the fact that they reflect only the functions of organizations, but not the processes, that cut the borders of functional cells.

Process approach requires glance on fundamental business processes from transfunctional perspective, that is across various functional divisions traditionally formed in enterprises [3, 6]. It forced development of new forms of organizational structures, as network or process structures. In enterprises organized around processes, basic organizational units are processes teams, directed on meeting internal and external customer needs. Processes runs horizontally through functional structure, as opposed to vertical labour division which is the base of traditional approaches towards organization managements [3, 9].

Mainly the Total Quality Management conception contributed to proceeding development of organizational structure in which teams play the main part [9]. The necessity of quick reaction on market signals (customer needs), introducing information technology, and team work determines organizational structure compressing [9]. In practice, passage from functional to process deception is not easy, because the concentration on processes leads to disrobement of former division for functions and specialties, for the benefit multifunctional employee’s teams, made for the specific processes needs. It should also be pointed that process orientation is not only a change of an organizational structure, but mainly development of organizational culture, as much as improvement of the abilities of team work among employees.

3. The proposal of the cost calculation method

Transfunctional character of pursued process in enterprises make traditional methods of cost calculation being not enough to gain precise cost data connected with these processes. Activity Based Costing (ABC) characterize with greater possibilities of describing cost of making particular actions, than division and additional methods, where bigger part of costs is calculated on cost drivers in averaged way or in the spread form. Moreover, traditional cost calculation methods do not enable determining cost of particular processes in enterprise, so improving processes is much more difficult. Implementing Activity Based Costing enables avoiding difficulties mentioned above [3].

That is why, the model of the cost calculation method based on the ABC method has been worked out. The proposed method includes four stages of proceeding:

- 1) Circumscribing the structure of the production process – selecting implemented activities.
- 2) Establishing the activities outputs.
- 3) Establishing activities outputs measures.
- 4) Assigning activities cost to products and calculating products cost.

The fundamental assumption of Activity Based Costing is that not products but activities implemented in organizations are directly responsible for generating cost. Selecting activities in enterprise is a starting point of calculation accordingly the ABC method. According to ISO 9001:2000 standard „any activity, or set of activities, that uses resources to transform inputs to outputs can be considered as a process” [10]. Activities may be selected using quality system procedures, production process documentation (production orders), technological documentation (technology cards, processing instructions), interviews and research conducted in the enterprise.

Activities of the production processes in enterprise may be divided into direct and indirect activities. Direct activities participate in the production process route directly. Indirect activities support direct activities and other indirect activities. Accounting cost of activities starts from the indirect activities, divided into levels, up to direct activities as it has been described [11]. Cost of activity is assigned to other activities according to the number of units of its output measure.

Exemplary structure of production process route with specified direct and indirect activities has been show in the figure 1.

Processes realized in enterprises consist of a number of activities. Before defining activities processes costs, first the cost of the individual cost cell should be defined. To define this, factory accounting sheet, in which intermediate indicating costs are accounted for organizational units in enterprises, may be used. These costs are accounted directly out according to consumption or indirectly according to proper keys of division. In production practice, one action is often made on many cost cells. In the balance sheet of activities for every cost cell one may isolate actions in which this particular cell takes part. Part of the activity “z” that is a part of the process “p”, realized on the cost cell “i”, was described as the action “k” – c_{pzki} . The activities which are a part of one action may also be made on different cells, whereas one cell may take part in realization of actions which are parts of different activities. This interrelation has been presented in the figure 2.

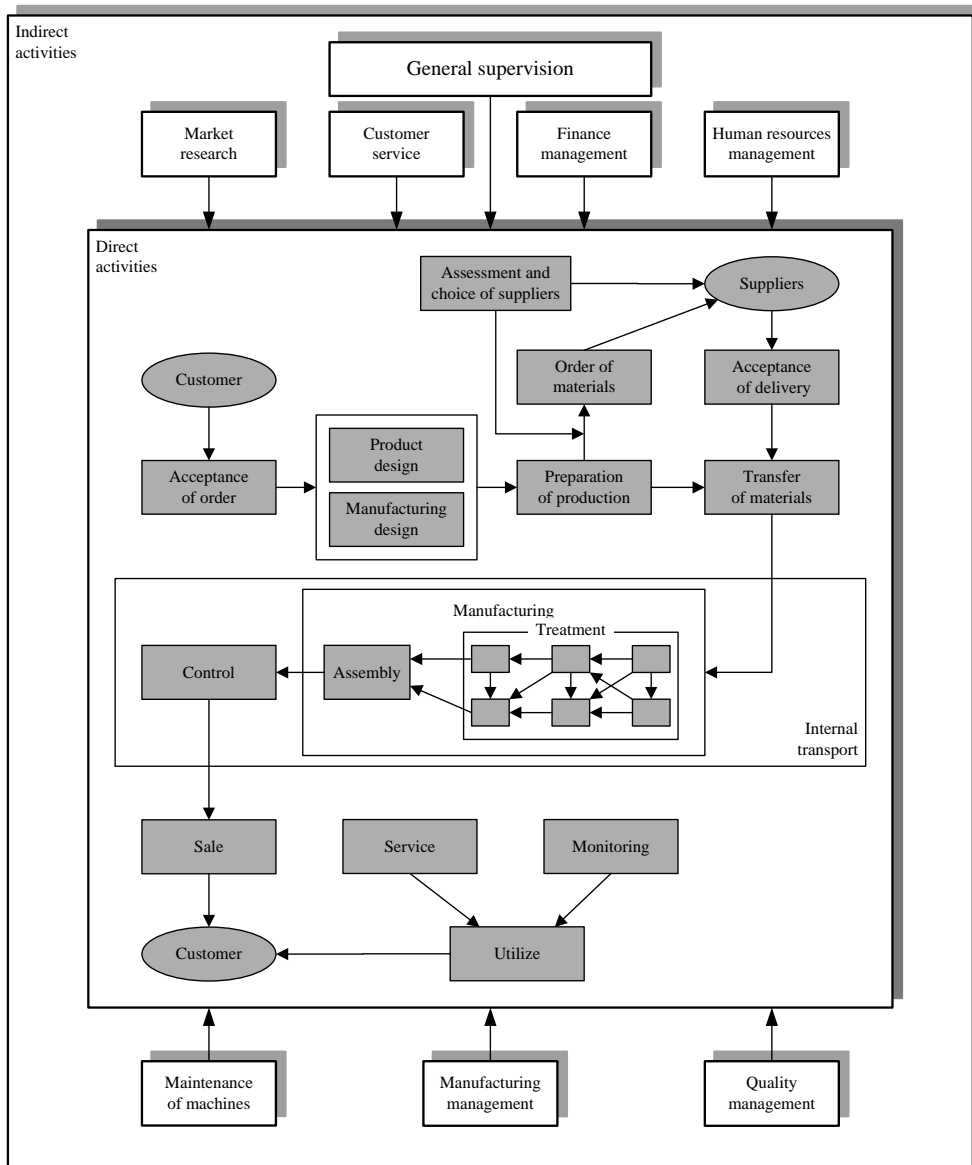


Fig. 1. Exemplary structure of production process route with specified direct and indirect activities (own elaboration based on [12])

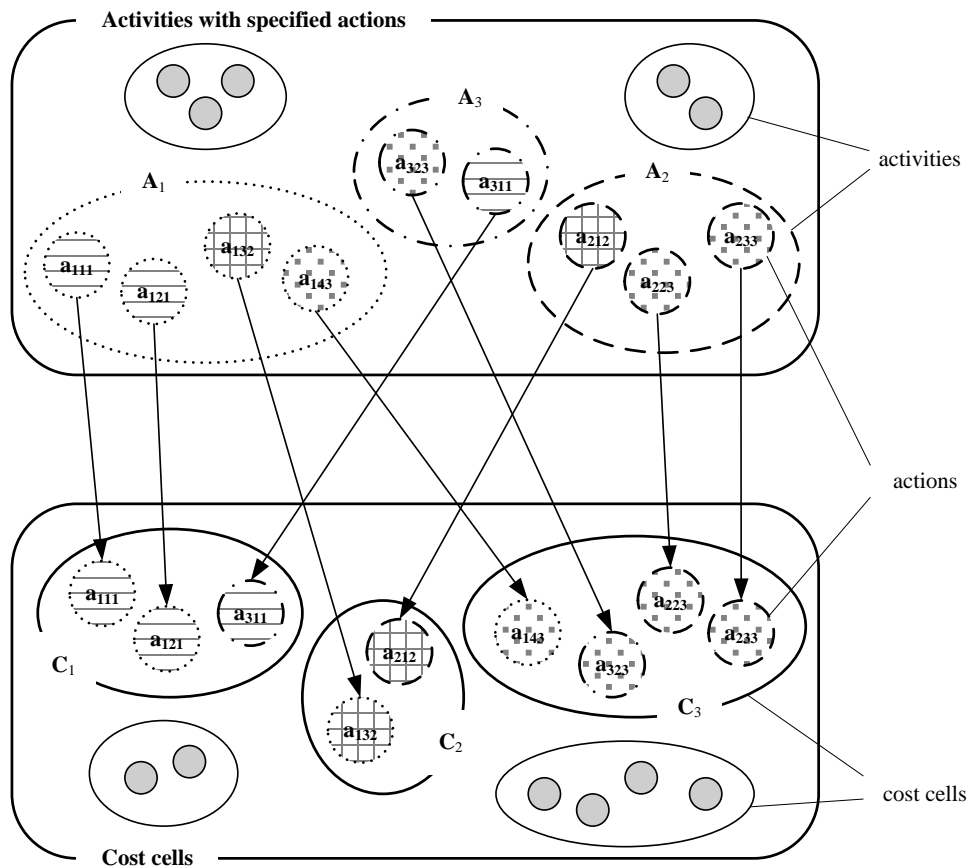


Fig. 2. Interrelation between actions and cost cells

The proposal of the balance sheet of activities has been presented in the fig. 3.

Explanation to the fig. 3 – examples of actions and activities:

- a_{D412} means action “1” included in the direct activity “4”, executed in the cost cell “2”,
- a_{I925} means action “2” included in the indirect activity “9”, executed in the cost cell “5”,
- A_{D3} means direct activity “3”.

After ascribing activities towards cost cells, assigning the indirect prime costs takes place.

COST CELLS													
Balance sheet of activities		Main production (1)			Production support (2)			Materials management (3)			Marketing and sale (4)		Administration (5)
Actions	a _{D111}	a _{D211}	a _{D311}	a _{D322}	a _{D412}	a _{I712}	a _{I722}	a _{I812}	a _{D423}	a _{I713}	a _{D524}	a _{I814}	a _{I925}
Cost of resources	Assigning the cost of resources: - to cost cells - to actions within activities												
Σ	TOTAL ACTION COST												
Activities				CALCULATION OF DIRECT AND INDIRECT ACTIVITIES COSTS									
Σ	CALCULATION OF DIRECT ACTIVITIES COSTS (WITH ASSIGNED COSTS OF INDIRECT ACTIVITIES)												
Indirect activities	Assigning costs of indirect activities												
Direct activities with assigned costs of indirect activities				CALCULATION OF DIRECT ACTIVITIES COSTS (WITH ASSIGNED COSTS OF INDIRECT ACTIVITIES)									
Σ	...												

Fig. 3. The balance sheet of activities

Therefore it is possible to present total process cost as a total cost of activities of this process, while cost of particular activity could be expressed as a total cost of its actions – formulas (1-4):

$$P_p = \{A_{pz}\} \quad (1)$$

$$c_p = \sum_{z=1}^Z c_{pz} \quad (2)$$

$$A_{pz} = \{a_{pzki}\} \quad (3)$$

$$c_{pz} = \sum_{k=1}^K c_{pzki} \quad (4)$$

where: P_p – process “p”,
 A_{pz} – activity “z” included in process “p”,
 c_p – process “p” cost,
 c_{pz} – activity “A_{pz}” cost,
 a_{pzki} – action “k” included in activity “A_{pz}”, executed in cell “i”,
 c_{pzki} – action “a_{pzki}” cost.

Next stages are establishing the activities outputs and establishing activities outputs measures. These measures are quantitative indicators of the activities effects . They are the base of assigning activities costs to products. These measures should [13]:

- express the demand of a particular cost object for the activities,
- reflect the causes of costs,
- be understandable and easy to measure,
- compromise between accuracy and cost measurement.

Selecting these measures (distribution keys) is a very difficult task, especially in conditions of diversified production program that characterizes piece and small batch production. Nevertheless, appropriately selected distribution keys determine accurate cost calculation. So the aim is to compromise between the accuracy of the calculation and the cost of obtaining relevant data.

Calculating the product unit cost requires defining the set of activities that are necessary to manufacture and sell the product. Moreover, determining the number of units of each activity assigned to the product is indispensable. Evaluating the activity cost rate and total activity cost assigned to the product is based on formulas (5-7):

$$x_z = \frac{c_z}{U_z} \quad (5)$$

$$u_z = \sum_{w=1}^W u_{zw} \quad (6)$$

$$c_{zw} = x_z \times u_{zw} \quad (7)$$

where: x_z – activity z cost rate,
 c_z – activity z cost,
 u_z – number of units of activity z output measure,
 u_{zw} – number of units of activity z output measure assigned to product w ,
 c_{zw} – activity z cost assigned to product w .

4. Process improvement in companies

The main aim of the process approach is making processes improvement in enterprises possible. That is why processes in organizations should be defined and described as carefully as possible. Process improvement needs introducing process measurement, otherwise criteria of process assessment would not be unambiguous. According to economic aspects of running business, financial measures of processes are especially crucial for business efficiency. Therefore, the proposed method of cost calculation seems to be fully justified. Running process cost account according to ABC method makes taking reasonable decisions connected with processes in enterprise possible. Analyzed processes implemented in organizations supply data to conduct cost calculation according to ABC method. As a result we get accurate information concerns effectiveness of making an action, amount of bearing costs or processes and actions demanding improvement. This information is used in taking decisions linked with perfecting those processes in enterprise. Due to Z. Zymonik [14], cost analysis and advantages connected with processes realization and researches of solutions making a success for enterprises require taking Rummler and Brache's three levels of efficiency into consideration: organization, process and work station.

Making the most of possibilities to processes improvement realized in enterprise could be possible thanks to preparing of Activity Based Management system – ABM [10]. This system focuses on processes management and actions in order to rising the value obtained by customer and increasing profits spring into existence thanks to creation of that value. That system should include analysis of factors that generate costs, activities analysis and efficiency measurement.

Cost calculation based on the ABC method has a lot of advantages. It allows to answer following questions:

- Which activities consume specified resources in the organization?
- What is the cost of individual processes and activities of the company?
- Why the organization needs to pursue particular activities and business processes?
- What factors influence the amount of the costs of individual processes and activities?
- What part of activities is due to specific groups of products, services and purchasers of the company products?
- Which activities performed within the process are value added, and which lead to the reduction of the process value?

It is also necessary to mention of limitations of using the ABC method in practice:

- operation of most enterprises based on traditional functional organizational structure,
- time-consuming process of implementation,
- the correct identification of activities in the organization and defining units of measurement,
- the need for involvement managers of all departments in the preparations for the implementation,
- significant effort and high cost of operation of the ABC system in organizations,
- the need for continuous updating of the system after implementation.

It should be remembered that despite difficulties associated with implementing and maintaining the cost account system based on the ABC method, detailed cost analysis of particular process phase of production system conducts to minimization total production costs simultaneously meeting demanding of product consumers. It is crucial, so that process analysis should be complex from economic results of enterprise activity point of view and include whole production system. We should move towards obtain possibly beneficial results for whole system, not just for chosen fragment.

References

1. Knosala R. i Zespół: Komputerowe wspomaganie zarządzania przedsiębiorstwem. Polskie Wydawnictwo Ekonomiczne, Warszawa, 2007.
2. Kucińska A.: Ocena skuteczności SZJ jako narzędzie jego doskonalenia. Problemy jakości, nr 5, 2007, pp. 17-21.
3. Matuszek J.: Inżynieria produkcji. Wydawnictwo Politechniki Łódzkiej, Filia w Bielsku-Białej, Bielsko-Biała, 2000.
4. Sobańska I. (red.): Rachunek kosztów. Podejście operacyjne i strategiczne. Wydawnictwo C.H. Beck, Warszawa, 2009.
5. Hamrol A.: Wybrane zagadnienia inżynierii jakości w przedsiębiorstwie produkcyjnym. Konferencja „Manufacturing ‘01. Współczesne problemy wytwarzania”, vol. 2, Poznań 2001, pp. 253-278.
6. Durlik I.: Reengineering i technologia informatyczna w restrukturyzacji procesów gospodarczych. WNT, Warszawa, 2002.
7. Valiris G., Glykas M.: Critical review of existing BPR methodologies. The need for a holistic approach. Business Process Management Journal, vol. 5, no. 1, 1999. pp. 65-86.
8. Norma PN-EN ISO 9001:2000 „Systemy zarządzania jakością. Wymagania”. Polski Komitet Normalizacyjny, wrzesień 2001.
9. Piotrowicz A.: Zmiany struktury organizacyjnej przedsiębiorstwa. Wydawnictwo Adam Marszałek, Toruń, 2002.
10. Miller J., Pniewski K., Polakowski M.: Zarządzanie kosztami działań. Wydawnictwo WIG – Press, Warszawa, 2000.
11. Kołosowski M., Chwastyk P.: Rozliczanie kosztów działań w systemie zapewnienia jakości. [w:] Knosala R. (red.): Komputerowo Zintegrowane Zarządzanie, tom I, Oficyna Wydawnicza PTZP, Opole, 2010, s. 695-702.

12. Więcek D.: Kalkulacja kosztów własnych produkcji w rachunku kosztów działań. Międzynarodowa Konferencja „Inżynieria Produkcji”, Bielsko-Biała, 2000, materiały konferencyjne, s. 152-166.
13. Nowak E., Piechota R., Wierzbński M.: Rachunek kosztów w zarządzaniu przedsiębiorstwem. Polskie Wydawnictwo Ekonomiczne, Warszawa, 2004.
14. Zymonik Z.: Koszty jakości w zarządzaniu przedsiębiorstwem. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003.

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