



## Management of Corporate Business Process Cost Performance Based on Key Costs Data

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### ABSTRACT

One of the most complex problems of implementing corporate process-based management includes arrangements for accounting and analysis of costs related to business process execution. Methods conventionally used to these ends cannot be leveraged in terms of business processes whose cost performance changes dynamically, which is particularly customary for companies in emerging markets. The methods proposed by this article authors are only based on accounting and analysis of most important key costs. In reliance on key costs, one develops an indirect costs exact distribution model, which indirect costs are related to the execution of various business processes. Key costs data is also used to analyze alternatives of cost reduction and risk minimization. This paper offers criteria for qualifying costs as key costs. Fundamental principles have been determined for developing an activity-based costing model based on key costs data, and trends in analysis of key costs have been established.

**Keywords:** Business Process Management, Cost Analysis, Activity-based Costing

**JEL Classifications:** D24, M4

### 1. INTRODUCTION

In current times, implementation of a process-based management philosophy has become somewhat symptomatic not only of companies in developed market economies, but also of companies in developing economies. In these countries, including Russia, activities for implementing process approach elements are primarily associated with the development of business process models, less often – with the transformation of business processes through re-engineering (Novikov et al., 2016). However, to another key problem – arrangement for management accounting schemes aimed at obtaining accurate and updated information on the execution of business processes – attention is given to a far smaller degree. Since, according to Peter Drucker's well-known determination, "You can't manage what you don't measure," the problem of developing a management accounting system echoing special aspects of the process approach is of fundamental importance (Fedchenko, 2015). As in the norm, the essential method of management accounting providing accurate information on the cost of business process execution includes the activity-based costing/activity-based management method (Grishina, 2008;

Cokins, 2015). The principal particulars of this method were stated in the paper (Kaplan and Bruns, 1987); at present time, this method has become a frequent practice in the world; in particular, a number of provisions prepared by the American Institute of Management Accountants provide insight into its utilization: "Implementing activity-based costing," (IMA, 2006), "implementing activity-based management: Avoiding the Pitfalls" (IMA, 1998) and others. Considerable attention to the problems of applying this method has been also paid by Russian scientists over the last years: There have been approached problems of developing a generic accounting system based on using this method (Mokeyeva et al., 2014; Parasotskaya, Mitronova, 2011), identifying the pattern of using the method in respect to individual areas of economic activities (Pochekeyeva, 2012), a comparative analysis of Russian and international practices (Samusenko, 2010), etc.

Let us take a brief look at the substance of this method. The concept of activity lies at the heart of it. Activities are works performed in a business environment, whose ultimate purpose is to manufacture and sell products. Consequently, activities may be deemed to be analogous procedures forming business processes. In order to

implement the method in a specific business environment, it is required to draw up a detailed list of functions performed. For each function, a cost value of various resources spent for it should be determined. The developed rules of assigning the cost of resources to the performance of specific functions (distribution factors) are commonly termed as resource drivers. Another type of the rules includes the rules of assigning the cost of activities to individual types of finished products (activity drivers) (Cokins et al., 1993).

Whereas the activity-based costing method has now gained a certain acceptance, its usage is associated with material difficulties. Development, implementation and maintenance of a corporate integrated activity-based costing model (resource drivers and activity drivers) require a vast amount of time, and in the context of a dynamically changing market environment (continuous modification of prices for raw and other materials, tariffs for energy resources, introduction of new technologies, etc.), this appears to be hard going. It is important to emphasize that present-day business process management systems (such as the metasonic suite system) are focused exactly on dynamically changing processes (Fleischmann, 2009; Kamennova, 2014). They provide an opportunity to introduce changes into the process model in real time, verify the model for errors, switch from the model to the software in execution, etc. (Vizgunov and Vizgunov, 2012; Chebotarev et al., 2010), but they by no means solve the problem of exact calculation of costs related to business process execution. Therefore, through the use of the present-day business process management systems, companies can promptly modify their business processes, but calculating costs for the execution of a process after its transformations will still require a laborious procedure for modification of the cost distribution model.

An attempt to simplify application of the method was made by Kaplan and Anderson (2004; 2007) through the creation of a modified time-driven activity-based costing method. Instead of various resource drivers, a cost estimate of time spent for performing an activity is used. The application of the time-driven activity-based costing method enables to simplify the indirect cost distribution procedures, provide an opportunity to reflect specifics of performing different activities, and make the best use of process execution time information contained in enterprise resource planning systems and business process management systems. However, distribution of time-driven indirect costs for the performance of individual activities is, in our opinion, applicable by far not to all types of resources used. For instance, the use of the time-driven activity-based costing method does not appear reasonable for the distribution of costs for maintaining an information system, transportation costs, expenses for packing and wrapping materials, etc. Other major deficiencies of the method are described in detail in the paper (Adkins, 2008).

## 2. METHODS

From our point of view, it makes sense to offer another alternative to simplify the procedures for the development and maintenance of the ABC model providing a more general cost distribution mechanism. Each group of indirect costs should identify most critical, key types of costs related to products manufacture and

sale. Only for these key types of costs and activities, through the performance of which such costs arise, resource drivers and activity drivers should be developed and maintained. For other types of costs, the exact distribution mechanism needs not be applied, their distribution will be carried out in a simpler manner – on the basis of estimated factors.

In general, the key types of costs should, in our opinion, be identified with due consideration of the following requirements:

1. The process cost of production calculated based on key costs data shall include all major changes in the structure and volume of expenses for manufacture of output products.
2. The key costs value data shall meet the information requirements of managers. This requirement provides for using information on the cost of production calculated on the basis of key costs data instead of information on the cost of production calculated using conventional methods as an information support of managerial activities.

To identify key costs, both quantitative and qualitative criteria should be used. In particular, the most important quantitative criteria, in our opinion, include a share of this type of costs in the total amount of resources used for manufacture of products and a degree of controllability of the type of costs. The degree of controllability identifies the capabilities of process owners to affect the size of costs. Many expenditures (such as expenses involved in the execution of procedures strictly regulated by legal requirements) are not controllable; therefore, arrangement for detailed and real-time accounting of such costs will not enable to identify provisions for reducing the cost of output products. Another major criterion for qualifying costs as key costs includes a share of costs in the total costs of production. There are good reasons to implement measures for finding opportunities to reduce the cost value for those cost items that constitute the best part of the cost of production. Maintaining accurate records and control of expenses whose amount is insignificant may result in an increase in the cost of the accounting system support by far exceeding the benefits of reducing such charges.

The qualitative criteria are defined by the level of risk inherent in the use of this type of resources. For instance, in the event that a raw material supplier holds a monopoly in its area, and under the existing manufacturing process management, a company cannot decline its services, this situation is of potential hazard to the company since the supplier may, at its own discretion, raise prices for its products. There is also another problem associated with a lack of availability of resources, which a company may encounter – a deficient supply on the markets of industrial commodities and labor force may sideline the output growth. While analyzing costs, it is required to take into account currency risks as well, that is why one of the criteria for qualifying costs as key costs includes the relationship between prices for resources and exchange-rate changes. This criterion is particularly relevant to companies in developing countries, for which the dynamics of the national currency rate are weakly predictable. A company bears the risks inherent in changes in foreign exchange rates not only when using foreign-made components in production, but also when its suppliers are at liberty to sell their products in the international

market – when the national currency is devaluated, such suppliers may fully cross over to foreign markets.

Let us consider the interrelation of the described criteria.

It is suggested to divide these criteria into two groups. The first group criteria establish the trend of searching for provisions to reduce costs. This group includes criteria of controllability and share of a cost item in the total costs of production. The second group comprises criteria of the lack of availability of resources used, the relationship between prices for resources and exchange-rate changes, etc., which are indicative of a high level of operating risks (risks of industrial dislocation, disruption of supplies of raw and other materials, etc.).

With that in mind, the significance level of cost elements should be determined individually based on the criteria incidental to the availability of provisions for cost reduction and on the criteria incidental to the magnitude of economic risks.

The significance level based on the criteria incidental to the availability of provisions for cost reduction may be defined according to the following formula:

$$L_{cr} = C_s * C_c \quad (1)$$

Where,  $L_{cr}$  is the significance level of this cost item based on the criteria of provisions for cost reduction ( $0 \leq L_{cr} \leq 1$ ),

$C_s$ ,  $C_c$  means the significance level based on the criterion of cost item share and on the criterion of cost item controllability respectively ( $0 \leq C_s, C_c \leq 1$ ).

This formula highlights the general principle of determining the significance of a cost item in terms of finding provisions for cost reduction: Only if such cost item constitutes the best part of the cost of production and is controllable, and efforts for cutting the expenditure of the relevant resources ensure a considerable reduction of costs in general.

It is different with the criteria incidental to the existence of risks. Here, the significance level according to individual criteria should be summed up since if a cost item has a zero significance level according to one of the criteria but a high significance level according to another, it should be taken into consideration while making managerial decisions. In order to make it possible to identify the significance of individual costs in a reasonable way, it is required to identify the “weight” of each criterion, i.e., the degree of its influence when taking decisions on whether this type of expenses is attributed to key costs. With that in mind, the significance level of an individual cost item according to the criteria incidental to the existence of risks may be defined using the formula:

$$L_{sr} = \sum_{k=1}^n p_k C_k \quad (2)$$

Where,  $L_{sr}$  is the significance level of this cost item based on the risk criteria,

$p_k$ , where  $k = 1, \dots, n$  is the “weight” of the  $k^{\text{th}}$  risk criterion,  $C_k$ , where  $k=1, \dots, n$  is the value of the  $k^{\text{th}}$  criterion for this cost item,

$n$  is the number of criteria.

After the key types of costs have been identified, the resource drivers have been identified for them, and the cost of production has been calculated based on them using the relevant activity drivers, it needs to be ascertained to what extent the cost of production calculated according to direct costs (subject to the direct-costing methodology) and the calculated “condensed” cost of production comprising only key types of costs dovetail into one another. If there is a one-to-one relation between these indicators, it may be concluded that the cost of production calculated according to key costs includes any significant cost elements determining the cost of production based on direct costs and may be used in analyzing and forecasting as the key indicator of costs (instead of the total cost or the cost calculated according to direct expenses). To identify the relation, it is suggested to use a linear correlation coefficient that is calculated as follows:

$$r_{x,y} = \frac{\text{Cov}(C, C_k)}{\sqrt{\text{Var}(C)\text{Var}(C_k)}} \quad (3)$$

Where,

$$\text{Cov}(C, C_k) = \left(\frac{1}{m}\right) * \sum_{l=1}^m (C_l - \bar{C})(C_{k_l} - \bar{C}_k) \quad (4)$$

$$\text{Var}(C) = \left(\frac{1}{m}\right) * \sum_{l=1}^m (C_l - \bar{C})^2 \quad (5)$$

$$\text{Var}(C_k) = \left(\frac{1}{m}\right) * \sum_{l=1}^m (C_{k_l} - \bar{C}_k)^2 \quad (6)$$

$m$  is the number of periods, for which the cost of production based on direct costs and the cost of production based on key costs have been calculated,

$C_l$ ,  $l = 1, \dots, m$  is the value of the cost of production calculated according to all direct expenses for the  $l^{\text{th}}$  period,

$C_{k_l}$ ,  $l = 1, \dots, m$  is the value of the cost of production calculated according to key expenses for the  $l^{\text{th}}$  period.

The value  $r_{xy}$  is within the range from  $(-1)$  to  $1$ . Providing that the value  $r_{xy}$  is close to  $1$ , then there is a quite high positive dependence between the cost of production based on direct expenses and the cost of production based on key expenses, and while analyzing costs and forecasting their changes, the cost of production according to key expenses may be used instead of the cost of production according to direct expenses. In case of obtaining a value other than the value  $r_{xy}$ , it may be deduced that the key cost items for this type of products have been identified incorrectly, and it is required to repeat the procedure of identifying significant types of expenses. Potential error reasons include a false measurement of the “weights” of individual criteria and an inadequate minimum

level of significance, where a cost element is attributed to key costs. It is important to note that in calculation of this coefficient, the cost of production based on direct expenses should be taken into consideration, rather than the total cost of production. The truth is that when calculating the total cost of production, quite conditional distribution coefficients are often used to distribute indirect expenses. Consequently, the total cost of production echoes real resource spending processes for manufacturing a specific type of products not in full measure. The use of the cost of production calculated on the basis of direct expenses allows obtaining of more accurate information.

The activity-based costing model developed on the ground of key costs ensures a vivid presentation of information on those types of costs, which are most important to the company, and an exact distribution of such costs among different types of output products. In addition, the activity-based costing model, within the framework of which only key costs are taken into account, is fairly straightforward to be maintained current. Thus, the use of key costs enables to drastically solve the problem of mismatch of business process models and cost distribution models related to the execution of these processes using the activity-based costing method, which problem arises while carrying out any process changes. Since the activity-based costing method is only applied to key costs, changes in business processes not involving any modification of the composition and structure of key costs require no redevelopment of the activity-based costing model.

Identifying key costs also provides for the creation of an information base for analyzing alternatives of cost reduction and risk minimization. Depending on what criteria a cost item has been classified as a key cost, it is possible to propose the following analysis categories for this group of expenses. If a cost item has been classified as a key cost according to the criteria incidental to the availability of provisions for cost reduction, it is required to identify possibilities to procure this type of resources at a lower price and analyze the efficiency of control when using this type of resources. If a cost item has been classified as a key cost according to the criteria of the lack of availability of resources used or the relationship between prices for resources and exchange-rate changes, then this type of costs is incidental to a high level of the risk of violation of production and commercial operations. To identify the level of risks inherent in cost management, it is required to evaluate the estimated extent of losses in the event of different worse case scenarios. After worse case scenarios related to any change in the status of key costs have been developed, and the amount of cumulative losses has been identified for each scenario, it is required to specify a list of measures aimed at the risk mitigation (diversification of investments, insurance, etc.).

### 3. RESULTS

Since the methodology suggested by the authors is primarily focused on companies in emerging markets, it makes sense to consider identification of key costs in the context of one of Russian companies. This company specializes in woodworking; its core processes include the processes of manufacturing and selling floor boards, window units, door units, mobile housing units, etc.,

and examples of supporting processes include the processes of timber delivery and drying. The cost of production data used as an information base for managerial decision making at the company prevents from obtaining accurate and vivid costing information and reflects no specifics of the manufacturing process since many cost items are consolidated (whereby dissimilar expenses are often included into the same group), indirect expenses are distributed on the basis of conditional coefficients, etc.

Arrangement of all indirect expenses for accurate records appears to be an extremely laborious procedure due to a great number of different cost elements and transactions stipulating their uprise. For instance, the list of transactions stipulating the uprise of transportation expenses for delivery of business inventories includes the following elements: Timber delivery by rail, timber delivery by truck, hardware delivery, bonding material delivery, etc. Performance of these activities is associated with the appearance of different cost elements: The cost of delivery for each type of transport; salaries of the company procurement and storage subdivision employees engaged in material acceptance; extra charges, commission fees, etc. Developing rules for assigning each cost element to individual activities, dividing the value of expenses incidental to material transportation into the core processes and other procedures providing an opportunity for accurate accounting of all types of expenses will require a vast amount of time; maintaining the model current appears to be even more difficult.

Let us consider how these problems can be solved if key costs data is used. The process of identifying key costs related to the manufacture of floor boards on the ground of total cost data is represented in Table 1.

While identifying expenses qualified as key costs according to the criteria incidental to the availability of provisions for cost reduction, one should assign the share of this type of expenses in the total cost of production (this information is provided in the second column of Table 1) and evaluate the degree of controllability. On the strength of these criteria, qualifying such types of direct expenses, as basic materials and base wages of direct labor (job-type), as key costs appears to be most obvious. The other significant cost items (transportation expenses and equipment maintenance charges) require a more profound analysis. Analyzing the structure of transportation expenses shows that the freight charge for timber shipment by rail accounts for more than 80% of the total costs. With that in mind, in respect to transportation expenses, only this type of expenses may be attributed to key costs. In order to assign the value of the timber delivery supporting process to the core processes, the activity-based costing model shall provide for the development of rules for distributing the total amount of freight charges for timber shipment by rail among the types of output finished products (the timber consumption by each production facility may be used as an activity driver). For other components of transportation expenses, the assignment to individual activities or processes makes no sense; when calculating the cost of production, they may be distributed among individual types of products on the basis of conventional conditional coefficients. Likewise, an analysis of expenses for equipment maintenance shows that the

**Table 1: Identification of key costs related to manufacture of floor boards**

Cost item	Share in overall volume (%)	Type of key costs	Criteria for qualifying costs as key costs	Activity driver
Basic materials	61.5	Basic materials	Share of costs, controllability	
Supporting materials	2.2	-	-	
Fuel for process needs	3.1	-	-	
Electric power for process needs	2.2	Electric power for process needs	Resource utilization risks	Meter readings in individual areas
Transportation expenses	4.3	Freight charge for timber shipment by rail	Share of costs, controllability	Timber consumption
Base wages of direct labor	6.1	Base wages	Share of costs, controllability	
Extra wages of direct labor	0.2	-	-	
Contributions to funds	1.6	-	-	
Shop costs	3.1	-	-	
Equipment maintenance charges	4.3	Wages of repair labor	Share of costs, controllability	Number of equipment repair requests
Works general expenses	2.5	-	-	
Non-production expenses	8.9	-	-	

main component of this item includes wages of repair labor. It is this cost element that should be attributed to key costs. For an exact distribution of expenses of this type, the number of repair requests for the equipment used in different production facilities may be considered as an activity driver (accordingly, for the activity “equipment repair”). An illustrative example of costs attributed to key costs based on the risk criteria includes expenses for electric power for process needs. The continuous growth of electric power tariffs and the high adoption value of technologies that could ensure saving of energy costs require both accurate records and ongoing monitoring of application of resources of this type. The problem of exact distribution of the cost of electric power may be solved through installing additional electric power meters in individual areas.

Therefore, the cost of production calculated according to the key costs comprises both direct expenses (basic materials, base wages of direct labor) and indirect expenses (freight charge for timber shipment by rail, wages of repair labor, and electric power for process needs whose cost is distributed at the company among different types of products in proportion to the cost of the basic materials). To distribute indirect expenses attributed to the key costs between different types of output products, a range of tools of the activity-based costing method is used – identification of the cost of activities stipulating the uprise of such expenses and activity drivers reflecting the specifics of resource spending as applied to the requirements of different production facilities (the activity drivers are shown in Table 1).

The value of the correlation coefficient calculated on the basis of the cost of production data according to direct costs and the cost of production data according to key costs for a period of 12 months accounts for 0.87, which proves the correctness of identifying the list of key costs and the feasibility of using the key costs data to arrange for cost management procedures.

The provided example also illustrates another important benefit of using the key costs – the ease of maintaining the activity-based costing model current, which is due to the fact that the indirect cost exact distribution procedures are only gone through in respect of

the key costs. Thus, any change in the timber delivery supporting business process associated, for instance, with warehouse inventory control automation, a reduction in the number of quality checks of received materials, document reconciliations, etc. requires no re-development of the activity-based costing model since it has no effect on the key costs.

#### 4. CONCLUSION

As can be seen from the above, the use of the activity-based costing model development procedures based on key costs provides the following benefits to a company:

- Obtaining latest, vivid and detailed information on the most important costs of the company,
- An exact distribution of key costs between different types of output products,
- Ease of maintaining the activity-based costing model current,
- A possibility to modify business process models without having to change the activity-based costing model,
- Creating an information base for analyzing alternatives of cost reduction and risk minimization.

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