USE OF ABC CALCULATIONS IN METALLURGICAL PRODUCTION

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Abstract

The paper focuses on the possibilities of calculation of ABC and their use in metallurgical production, based on the Activity Based Costing calculation method. Primarily, the conditions necessary to ensure the allocation of the cost of sub-activities to cost objects are defined, which are in the final stage of the allocation the products (units of calculation). The article also shows the metallurgical operations (metallurgical facilities), where the use of ABC calculations is not only appropriate, but also beneficial. Also the basic conditions are given about information and organization support of these calculations.

Keywords: Calculation, activity based costing, allocation, ABC calculations

1. INTRODUCTION

Application of the Activity Based Costing method (ABC) for processing the ABC calculations in metallurgical production is particularly beneficial for products manufactured with multi-stage process technologies. This concerns especially tubes, pipes and hollow profiles incl. accessories, drawn and cold-formed products, metallurgical products made from precious and non-ferrous metals and foundry products.

In the context of ABC, process costs are allocated to cost objects. A process means an organized sequence of sub-activities (actions) resulting in creation of products. There could be core processes core (production processes) and side processes (supporting, e.g. maintenance, transport, control, etc., or control - manufacturing and administrative overhead). The ABC method assumes that all side processes (support and control) should contribute to the fulfillment of the core (production) processes. [1]

The ABC method, unlike the traditional costing methods, does not perform the "cost allocation to cost centers" for products in detail from the overheads group (units of calculation), but performs "process cost allocation" for products in detail for the sub-activities (actions) of these processes, which are essential for the building (creation) of these products. [2]

There are usually two basic allocation stages of process cost allocation to cost objects in metallurgical production.

Part of the first allocation phase is separation of the processes to main and side ones (support, control), including the definition of the costs incurred by these processes. The first phase also defines the appropriate cost drivers which are used to allocate costs of side processes to cost objects in the form of core processes.

In the second allocation phase, the cost objects are defined already in the form of fabricated metallurgical products (units of calculation) within each core (manufacturing) process, and also the appropriate cost drivers are defined which are used to allocate the cost of the core processes to these products. [3]

2. METHODS DATA

Part of the first allocation phase, in addition to defining sub-activities within the main and side processes, is monitoring and planning of primary costs of these activities within the so-called process centers. Part of the

first allocation phase is also to define appropriate cost drivers which will reflect as closely as possible the causal relationship between the cost of these activities and cost objects that consume these activities. [4]

The standard accounting systems book the costs to analytical accounts, cost centers, or even contracts. To use the ABC method, however, it is necessary to ensure that the accounting recognizes costs of sub-activities within the core and side processes in the so-called process centers. The simplest solution is to define specific accounting centers for each activity, which from the perspective of management accounting are the aforementioned process centers. To secure the information base for the preliminary and especially the final ABC calculations, it is necessary to ensure that the accounting recognizes (records) the primary costs of each sub-activity within these process centers. [5]

For the core processes of metallurgical production, it is appropriate to define the process centers for sub-activities carried out within each major manufacturing facility, which support the sequential (not continuous) technological processes. In accounting, each such production facility is recorded separately within tangible fixed assets, for which the accounting allocates costs in the form of depreciation. The accounting can also - without any major problems - allocate costs of spare parts and maintenance costs and routine repairs by outsourced companies to those facilities (process centers). Certain internal measures, however, require charging performance related to maintenance and routine repairs performed by own (in-house) maintenance. Registration measures also require charging labor costs to the production facilities (process centers) associated with their use.

For side processes, ABC calculations require clarification of cost accounting within the process centers for the in-house maintenance, transport, energy, etc.

A necessary part of the first allocation phase is also planning and monitoring of consumption of activities of the side processes by the core processes, also within the corresponding cost drivers. This provides an information basis for allocation of costs of the side processes to the core processes. The calculation of this allocation is slightly more complicated if it has to deal with mutual consumption of activities between the individual side processes (e.g. the handover of sub-activities between maintenance, energy and transport).

In the second phase of the allocation, the consumption of activities of the core processes for manufacture of products for which the ABC calculations are to be performed, have to be defined, preferably within the specific consumption corresponding to consumption of the cost drivers per unit of production. Monitoring of actual consumption activities of the core processes for the manufacture of individual products, whether on a production unit or in absolute terms, represents quite a serious problem in metallurgical production. It can be bypassed by using projected values for the final calculations, which are eventually corrected for the observed deviations from reality.

2.1. Definition of Cost Drivers

When using the ABC method in metallurgical production it is necessary to define cost drivers separately for each activity. For the consumption of sub-activities of the side processes, cost drivers characteristic for these activities are used. In the case of maintenance, the cost drivers are minutes or hours of these activities. For power supply for example KWh, GJ or m3 are used, for transport performances e.g. km, ton/km, hours, etc.

For the consumption of sub- activities of the core processes in the manufacture of products, the most suitable and also the most widely used are the cost drivers of labor intensity, expressed mostly in minutes of machine time per unit of production of these products (mostly metric ton, meter or piece).

2.2. Definition of Volumes (Values) of the Cost Drivers

When allocating activities of the side processes, the volumes of cost drivers express the planned or actual consumption of these activities by the core processes, or mutually between the side processes. The planned

consumption is based on individual performance plans of the side centers, the actual one then on accounting or operational records.

When allocating activities of the core processes, the values of specific consumption of the cost drivers express the consumption of these activities per unit of production of products (units of calculation). The consumption of activities of the core processes for the planned or actual production volume of individual products is based on the specific consumption multiplicated by the value of the planned or actual production volume of the products.

2.3. Calculation of Calculation Rate of Cost Driver

An important part of the ABC calculations are the so called calculation rates of sub-activities, which de facto means calculation rates for units of the respective cost drivers. This calculation is based on the proportions of the total cost of sub-activities and the total volume of consumed units of these activities (cost drivers) by the cost objects. [6]

3. EXPERIMENTAL PART

The calculating rates of sub-activities have to match the total costs expended on these activities. In other words, it must be true that for this allocation using cost drivers it is ensured that the value of the total costs of these activities is accurately allocated to the cost objects.

3.1. Calculation of Calculation Rates of Activities of Side Processes

In determining the calculation rates of activities of side processes consumed by core processes, it is therefore necessary that the calculation rate is based on the proportion of the total cost of the activity and the total volume of consumed units of this activity, expressed through cost drivers. [7] This calculation is then based on the equation (1).

$$ks_{VA_i} = \frac{N_{VA_i}}{VV_{VA_i}} \tag{1}$$

ks_{VAi} - Calculation rate if the $i\text{-}th$ activity of a side process (CZK)
VA_i - $i\text{-}th$ sub- activity of a side process
N_{VAi} - Total costs of the $i\text{-}th$ activity of a side process (CZK)
VV_{VAi} - Volume of cost drivers expressing the consumption of the i-th activity of a side process

3.2. Allocation of Activity Costs of Side Processes to Core Processes

Calculation of allocation of costs of sub-activities of side processes on the activity of the core processes is based on the equation (2).

$$N_{VA_i} = \left(ks_{VA_i} VV_{H_1VA_i} + ks_{VA_i} VV_{H_2VA_i} + \cdots + ks_{VA_i} VV_{H_kVA_i}\right) = \sum_{i=1}^{k} ks_{VA_i} \cdot VV_{H_kVA_i} \tag{2}$$

VV_{HkVAi} - Volume of cost drivers expressing the consumption of the $i\text{-}th$ activity of a side process by the $k\text{-}th$ core process
H_k - $k\text{-}th$ activity of a core process

3.3. Calculation of Calculation Rates of Activities of Core Processes

When determining the calculation rates of activities of the core processes consumed by cost objects in the form of products (units of calculation), one must first calculate the total volume of these activities in units of the respective cost drivers, consumed during the production of these products. The calculation formula is then displayed as equation (3).

$$ks_{HA_i} = \frac{N_{HA_i}}{vv_1 Q_1 + vv_2 Q_2 + \cdots + vv_k Q_k} = \frac{N_{HA_i}}{\sum_{i=1}^{k} vv_i Q_i} = \frac{N_{HA_i}}{VV_{HA_i}} \quad (3)$$

ks_{HAi} Calculation rate of the *i-th* activity of core process (CZK)
HA_i *i-th* sub-activity of core process
N_{Hai} Total costs on the *i-th* activity of core process (CZK)
vv_k Specific consumption of cost drivers of the *k-th* product
Q_k Volume of production of the *k-th* product
VV_{Hai} Volume of cost drivers reflecting the consumption of the *i-th* activity of core process

3.4. Allocation of Activity Costs of Core Processes to Products

The calculation of allocation of costs of sub-activities of core processes to products is based on the equation (4).

$$N_{HA_i} = \left(ks_{HA_i} VV_{P_1 HA_i} + ks_{PA_i} VV_{P_2 HA_i} + \cdots + ks_{PA_i} VV_{P_k A_i}\right) = \sum_{i=1}^{k} ks_{HA_i} \cdot VV_{P_k HA_i} \quad (4)$$

VV_{PkHAi} - Volume of cost drivers reflecting the consumption of the *i-th* activity of core process by the *k-th* product
P_k - *k-th* product

Table 1 shows an example of allocation of total costs of activity A1 of core process to products.

Table 1 Example of allocation of total costs of activity A1 to produced units of calculation

Allocation of costs of activity A1: CZK 3 600 000.00					
Unit of calculation	**Production volume tons**	**Cost driver labor intensity min/ ton**	**Total production time minutes**	**Calculation rate CZK /min.**	**Costs of activity A1 allocated to products**
Product V1	12 658	12.60	159 490.80	5.803337654	925 578.97
Product V2	390	35.62	13 891.80	5.803337654	80 618.81
Product V3	1 853	13.68	25 349.04	5.803337654	147 109.04
Product V4	2 498	15.68	39 168.64	5.803337654	227 308.84
Product V5	8795	42.30	372 028.50	5.803337654	2 159 007.00
Product V6	689	15.10	10 403.90	5.803337654	60 377.34
TOTAL	**26 883**		**620 332.68**		**3 600 000.00**
Calculation rate =	5.803337654 = CZK 3 600 000 / 620 332.68 minutes				

4. RECOMMENDATIONS

ABC calculations are more complicated when compared to other calculation method, because it is necessary to ensure cost allocation of sub-activities of the core processes to the products (units of calculation) which consumed them during production. This requires more accurate information base, particularly in the accounting and operational records, where it is necessary to monitor both the cost of sub-activities and their consumption on the manufacture of individual products within the context of the defined cost drivers. As noted above, these cost drivers should reflect a causal relationship between the production of products and consumed activities of core processes during this production.

In the area of product cost the situation is simpler, because it is only logical that they are not allocated, but primarily directly calculated per each unit of calculation (product), based on the valuation of specific consumption of unit inputs featured in bills of materials

ABC calculations are sometimes accused of (given the aforementioned calculation methodology of determination of calculation rates of sub-activities) not being able to handle the variable and fixed costs separately, which ultimately does not allow calculation of the contribution margin. But this disadvantage can be fairly easily solved by dividing calculation of these rates to variable and fixed part. However, this also requires splitting the costs of individual activities to variable and fixed part. In this context it should be noted that a similar situation occurs with consumption of intermediate products, if they are valuated with a single sale price. The solution here is similar and again consists of dividing this price into variable and fixed part, which is not a problem if in the actual calculations of such intermediate products the costs are divided into variable and fixed part.

5. CONCLUSION

The ABC calculations can be effectively used in metallurgical production primarily when the production process is more complex, and especially if the production process is different for each product type, i.e. when various technological procedures are used. The benefits of these calculations cannot be expected in one-stage production, or in multi-stage manufacturing production, where technological process is basically identical for all products.

The actual use of minute rates (CZK/min) when processing calculations of metallurgical products, which are based on the consumption of time to process the products within each major manufacturing facility is common practice, and at first glance it belongs to the methodology of ABC calculations. The frequent problem in these cases is that it is usually a group of multiple sub-activities, or just few of the most important ones. The costs of other activities are then allocated to products already using a classic approach in the context of manufacturing overhead.

The proper methodology for ABC calculations calls for allocation of the majority of production (technological) sub-activities to individual products, depending on which products consume these activities and in what amount. These consumptions should then be expressed within the cost drivers.

It has to be said though, that ABC calculations definitely reflect the consumption of production costs of each product more accurately; the actual introduction and maintenance of ABC is however more laborious than for other calculations. Despite that there are significant metallurgical enterprises that have introduced the ABC calculations and are using it for planning and evaluation of contracts.

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