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Implementing some mathematical models to be applied in the cost calculation systems

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ABSTRACT. An improvement of the classical model for determining the cost of goods, in condition in which we assist a new governance in the economic entity, based on the cost allocation of resources consumption connected to the activity efficiency is proposed. This model applies a series of coefficients in allocation process of the indirect expenses over the cost at different level of activity and responsibility like: production, administration and sales.

1. INTRODUCTION

The cost represents an economic category which can be applied a lot in the economic life. Both at the macro and micro-economic levels the cost is the expression of resource consumption engaged in society for achieving a good result, objectives or an economic effect. The economic goods are identified in the daily economic life with the products, works, services and the activities performed in the economic units and have two economic values: usage value and intrinsic value. The apparition and development of cost calculation systems is based on the precise calculation of the future cost of products, works, services and activities performed by the economic entities, based on mathematical models. The evolution of the cost calculation systems has been influenced by the following factors:

- the production or activity type performed by the economic entities;
- the cost category used in managerial decisions: direct cost, production cost, complete cost, partial cost or activity cost;
- the evolution of the forces balance between the market components, that is the supply and the demand;

Under the incidence of these factors have been outlined and developed unitary cost calculation systems which can be found in two calculation systems:

- the complete costs system;
- the partial costs system.

The complete costs system is made of an assembly of procedures, methods and calculation principles for unitary costs which have in view the totality of expenditures engaged when making a product, services or activities. The classification criterion for the expenses included in the costs used in the complete costs system

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has in view grouping the expenditures according to their causative link with the product, work, service or activity performed, respectively with the possibility of identifying them with the calculation object. From this point of view expenditures are grouped in direct and indirect expenditures. The direct and indirect expenditures can be detailed in expenditure structures, in expenditure primary elements or calculation articles. The calculation methods from the complete cost systems can be grouped in two new categories respectively in classical cost calculation methods and modern cost calculation methods. Among the classical cost calculation methods we remark the following ones:

- global costs calculation method;
- cost calculation methods based on manufacturing orders;
- cost calculation methods based on manufacturing stages;

Among the modern cost calculation methods we remark ABC method (activity based costing) and target costing. We present the classical model of cost determination :

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$$c_u = \frac{c_d + c_{ind} \times k}{Q}$$

where

- c_u is the unitary cost;
- c_d are the directly expenses;
- c_{ind} are the indirect expenses;
- k is the rational allocated coefficient,

$$k = \frac{real\ activity\ level}{normal\ activity\ level}$$

This model presents the disadvantage that treats in a global way all indirect expenses and negatively influences costs.

2. Proposed model

The application of mathematical models for unitary cost calculation should take into account the new managerial system of responsibilities at certain decisional levels which should have for an effect the insurance of a certain control over cost administration, especially of the indirect ones, in the limits established by the income and expenditure budgets. Thus the level of indirect expenses (production, administration or sale) which have a causative link with the calculation object, which is situated over the budgeted level and those which correspond to the subactivity level of the entity or must be placed directly on the cost and not included in different cost categories.

Thus the adjustment of thee expenditures should be done on the basis of some correction coefficients calculated on the basis of effective or technical economic indicators of the effective activity.

In order to determine the coefficients, which will be named k_1, k_2 and k_3 respectively, we have used two levels of approach:

- Effective level of activity;
- Previous or budgeted level of activity.

The technical and economic indicators used in cost adjustment can be summarized in the following way:

- the indicators concerning the activity degree used in allocation costs of the indirect expenditures caused by the activity of the production sections and which are part of the section cost;
- the activity degree

$$k_1 = \frac{\textit{effective activity}}{\textit{normal capacity}}.$$

The effective activity represents the achieved level of the activity expressed in physical units and the normal capacity represents the level of production as planned in the technical documentation of the equipment and the production capacity.

In this situation the activity degree represents an activity indicator used also in the cost calculation system from Romania, after the French model, accepted as deduction coefficient of the structure expenditures.

The indicator k_2 concerns with the level of the administrative function management , efficiency determined as the rapport between the budgeted expenditures at the level of the administrative function and the effective expenditures.

$$k_2 = \frac{\textit{level of budgeted administration expenditures}}{\textit{level of effective administration expenditures}}$$

The model starts from the premise that the budgeted expenditures represent the ideal level of administrative expenditures engaged by the decision factor and accepted to be inducted in the costs.

In the situation the coefficient is over unit value, in the calculation of the effective cost we take into account its unitary value, including in the costs just the effective administrative expenditures.

In the situation the coefficient is under unit value we take into account its effective value, including in the costs just the level of effective administrative expenditures achieved in the limit of the expenditures budget.

Exceeding the administrative expenditures is caused by ineffective administration of the administrative sector.

Consequently these expenditures will be affected directly from the result period of the decision factor.

This disaffection of the effective costs has for a consequence maintaining the companies on the market through competitive costs and prices. The administrative cost savings are determined by the relation:

$$Ec_{ad} = (1 - k_2) \times c_{ad}$$

where Ec_{ad} means savings of administrative expenses.

k_3 is an indicator concerning the level of sale or commercial function management, determined as the rapport between the budgeted expenditures at the level of the administrative function and the effective expenditures:

$$k_3 = \frac{\textit{the level of budgeted sale expenditures}}{\textit{the level of effective sale expenditures}}$$

With the help of these indicators we adjust the sale expenditures which will be included in the products cost.

The manner of elaborating the sale expenditures in costs is similar to that of administrative expenditures charging on costs just the effective sale expenditures situated at the limit of budgeted expenditures.

In this respect the calculation of the unitary cost of a product can be determined by the following relation:

$$c_u = \frac{c_d + c_{ip} \times k_1 + c_{iad} \times k_2 + c_{is} \times k_3}{Q}$$

The calculation model of the classical unitary cost is determined by applying only one correction indicator for indirect expenditures included in costs respectively the activity degree applied to the total level of indirect expenditures.

The new model for calculating the unitary cost associates the calculation of costs with another tool of activity management respectively with the system of income and expenditure budgets and the delegation of responsibility to decision factors at each budgeting level.

Consequently exceeding the budgeted expenditures is punished by charging them to the decision factors, applying in the calculation the correction coefficients which represent the indicators of the production, administration and sale activity, regarded as main cost-generating activities.

3. CASE STUDY

An economic entity makes in an administrative period 1000 pieces product A for which it associates the following expenditures:

- direct raw materials expenditures = 10,000 RON
- salary expenditure = 5,000 RON
- indirect production expenditures = 1,500 RON
- indirect administrative expenditures = 1,320 RON
- indirect sale expenditures = 895 RON

The activity degree respectively the usage degree of the production capacities is 90The indirect budgeted expenditures per activities are as follows:

- indirect production expenditures = 1,350 RON
- indirect administrative expenditures = 1,254 RON
- indirect sale expenditures = 716 RON

The calculation of the unitary cost after the two cost calculation models are given in the following.

Using the classical model we have:

$$\begin{aligned} c_u &= \frac{c_d + c_{ind} \times k}{Q} \\ &= \frac{15000 + (1500 + 1320 + 895) \times 90\%}{1000} \\ &= 18.343 \text{ RON/unit.} \end{aligned}$$

Using the proposed model:

$$\begin{aligned} c_u &= \frac{c_d + c_{ip} \times k_1 + c_{iad} \times k_2 + c_{is} \times k_3}{Q} \\ &= \frac{15000 + (1500 \times \frac{1350}{1500} + 1320 \times \frac{1254}{1320} + 895 \times \frac{716}{895}) \times 90\%}{1000} \\ &= 18.32 \text{ RON/unit.} \end{aligned}$$

4. Conclusions

The advantages of this unitary costs calculation model in the complete costs system can be summarized in the following aspects.

It provides a certain stability to the costs for longer periods of time by including the indirect effective expenditures generated by the production, administration or sale function to the level of budgeted expenditures. Under these circumstances exceeding these levels is charged to the decision factors.

There is a double management control of the activity by costs and through the income and expenditure budgets of the activity.

There is much more responsibility for the decision factors that participate in the elaboration of income and expenditure budgets through a more responsible substantiation of the indirect expenditure budgets on the functions of the economic utilities.

It provides more credibility towards clients in the situation of order production by elaborating a closer to reality anti-calculation, without including in the order cost of some hidden costs due to bad management.

It provides a control of indirect expenses for each production stage in the situation they take place in different production sections.

It avoids the movement of inefficiency activity in the cost.

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