Development of a methodology for sharing the enterprise total costs into the fixed and variable components in the cost-management tools' improvement

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Abstract.   The problems associated with cost management become especially acute and urgent in modern competitive environment. These issues are much more relevant for the construction industry than for other industries, since the costs and expenses on the construction products are much higher than those of other industries. Cost management is an excellent tool for the development and justification of many diverse management decisions, which can be associated not only with reduction, costs optimization or product pricing, but also with the production program of the enterprise, and in some cases with the organizational structure of enterprise management. However, the current cost management tools are currently poorly adapted to the Russian conditions and the Russian mentality and practically are not adapted for construction. This is the relevance of the chosen research topic. The methodology developed by the author for sharing the enterprise total costs into fixed and variable components will make it possible to quickly and inexpensively obtain the initial data for the use of existing and non-adapted Western tools for domestic enterprises in modern market conditions. Also, any classification is the additional information that gives an opportunity to more thoroughly and accurately examine the selected object, which in our case is the cost.

Introduction

Market economy also involves the competition of various types and levels, in which the enterprises and organizations' state, including financial, plays a key role. Only a steady state of enterprises and a strong position in the market for manufactured products can be the key for the long successful activity. This state can be achieved through systematic work on the production control, the resources expenditure and the sale of products, works, services. The key factor on enterprise profits are the various cost management tools.

The relevance of research in this area is confirmed by the fact that cost management issues become especially acute in the face of competition for the construction industry, which is associated with high costs of construction production and the cost of construction products. The existing cost management tools are currently poorly adapted to the Russian conditions and the Russian mentality and are practically not adapted for construction. Construction products are so large and expensive that even the basic input data for the existing tools are collected over the years, and as a result they simply become irrelevant. If we take a smaller division - construction and installation work, then it is necessary to adapt the tools for this type of activity, that is, not for goods and products, but for work, among which there are many

different natural units of measurement and a huge amount of work in progress. In addition, the cost of organizing management accounting, the data of which can be taken as a source of cost management tools, is much higher in construction than in other industries, which is primarily associated with the staff qualifications.

The aim of the study is to improve the theoretical and methodological provisions and applied practical recommendations on the development of approaches to the organization's cost management process and their adaptation to domestic business entities of the construction industry.

The specifics of enterprise cost management using the example of construction and other industries are presented in foreign publications by such authors as Tsapko, K.A., Alyaeva, M.Y. [1], the role of costs in increasing the organizations' competitiveness is noted by Gornostaeva, Z.V., Kushnaryova, I.V., Alekhina, E.S. [2], Abramov, D.V., Anopchenko, T.Y., Gubachev, V.A., Volgina, S.V., Revunov, S.V. [3], the organizations' financial security was dealt with by Krokhicheva G.E., Lesnyak V.V., Selezneva E.M., Arakelyants E.S. [4], the importance of cost management in the production costs' formation was noted by Sekisov A.N., Degtyareva O.G., Samsonova N.V., Grigoryan M.N. [5], Kostuchenko V., Zdanov A., Rodionov A. [6], Anopchenko T.Y., Murzin A.D. [7], management and resource allocation strategies were reviewed by L. Trigeorgis [8], Rogovenko T., Zaitseva M. [9] and others.

In spite of the fact that the diverse publications on cost management, expenses management of a construction project, the development criteria for budget valuation and market pricing methods are regularly published [10], the area of sharing the total costs of the enterprise into the fixed and variable components as a part of the cost-management tools' improvement.

Materials and methods

Cost management is an excellent tool for the development and justification of many diverse management decisions, which can be associated not only with reduction, optimization of costs or product pricing, but also with the production program of an enterprise, and in some cases with the organizational structure of the enterprise management. Many cost-management techniques have been developed and successfully applied: standard-cost, direct-costing, the ABC method, target-costing, kaizen-costing and many others. For the most part, these are the Western methods, poorly adapted to the realities of today's Russia. In addition, the use of many techniques requires a rather specific and little-used classification of the fixed and variable costs in Russia. Even for those methods where this classification is not necessary, it certainly will not hurt and will provide the cost manager with additional information that makes the picture of the costs and their structure complete and reliable. We also all know perfectly well that any classification is additional information that makes it possible to more thoroughly and accurately examine the selected object, be it costs, as in our case, or something else. Moreover, if the information was received without much difficulty and practically free of charge, there is hardly a manager who will reject this information.

However, to obtain such information at enterprises, it is necessary to organize the specific managerial accounting, which is organized far from every domestic enterprise due to the fact that it is not mandatory, and if it is not mandatory, it is most often considered by management as unnecessary, since its organization requires additional costs. But it is not enough to organize the management accounting at the enterprise, it is also necessary to add the costs' separation into the fixed and variable components as a function, which, possibly, will entail not only the additional costs, but also may cause misunderstanding on the part of the relevant personnel. A way out of this situation would be a toolkit that gives an opportunity to quickly and inexpensively share the total cost of the enterprise production into fixed and variable components and uses the initial data already available at all enterprises.

Discussions and Results

To solve these problems, we propose a method for sharing the total costs of the enterprise into the fixed and variable components. The proposed methodology is good in that it is possible use the data on the financial performance report that are available in any organization as source data, moreover, it is possible to use the results of not only periods following one after another, but also following with some

gap. In this situation, several points that are proposed to be called assumptions or restrictions are important:

1. The levels chosen for the observation should not only be relevant, that is, within the real capabilities of the real enterprise, but also with a minimum deviation. Moreover, according to the author, the calculation results will be more accurate the smaller deviation in the levels of production volumes accepted for the calculations as initial data. Only in this case it is possible to assume that the fixed costs' total amount level will not change, as well as the rate of variable costs per unit of output. With significant fluctuations in production volumes, there is a possibility that the fixed costs will increase, for example, the costs for managers to pay related to quality control of finished products, or rental costs for additional warehouses of both finished products and raw materials. With an equal degree of probability, the rate of variable costs per output unit may decrease as a result of the specialization deepening, the increase of production, the appearance of secondary industries, etc.

2. It is fundamentally important that the production program of the periods selected for the calculation should be practically the same and differ only in a small deviation in the production volume. Ideally, the variances for the various products should be identical. But there should be no change in the production structure, since this will entail a change in the structure of costs, namely, the rates of variable costs in a production unit.

3. The operational key factor rule should be observed, which is related to the ratio of the revenue increase (or decrease) to the profit increase (or decrease): the profit increase (or decrease) should dominate the revenue increase (or decrease). Otherwise, some third forces and factors are connected, as a result of the influence of which not only the structure of products, works, services is changed, but also, as a result, the cost structure. In this case, the amount of fixed costs and the rate of variable costs will also change.

4. To apply the proposed methodology, the initial data of different but comparable periods can be used: year, half year, quarter, month, and even decade. Moreover, time intervals (years or months), the data of which are used as input, are not required to go in a row. It is only important that the remaining assumptions are observed. It is hardly worth using, for example, the data of the first and third quarter in a construction organization, since the seasonal variations in the structure of the work performed, and therefore in the cost structure, are possible here. However, according to the author, the financial results of the periods closest to each other should be used as initial data, since the change probability in the production program structure and, accordingly, the cost structure will be directly proportional to the interval between the periods: the closer the periods are to each other, the less likely the cost structure change will occur.

On the one hand, such conditions tear us from reality and place us in laboratory sterility, which is unlikely for the real economy, and on the other hand, these are very real conditions for a stable economy with low inflation and a stable competitive market.

The proposed assumptions are based on the following points. Fixed and variable costs are often called conditionally fixed and conditionally variable. The conventionality of such a division is based on the fact that costs can be called "fixed and variable", only under certain conditions, the main of which are comparable relevant levels of business activity. In other words, production volumes should not change too much. What is the reason for this condition? How can a significant change in volumes affect, for example, the fixed costs?

Despite the fact that the fixed costs do not change with changes in production volumes, with significant fluctuations in this volume, they will still change. For example, additional management personnel will be required to control the finished products' quality if its quantity in physical terms significantly increases. Additional storage space may also be required to store that finished product, which will also affect the fixed costs.

A significant increase in production volumes will affect the variable costs, not only total costs, which is quite legal and justified, but also the unit costs, that is, the rate of variable costs per output unit. This can happen, for example, due to the strong skill development among the workers directly producing finished products or their elements, which will result in an increase in labor productivity. And if these

workers receive wages on a time-based basis, which is far from rare in domestic enterprises, then the labor costs per output unit will be reduced both in time and in cost. For the same reason, the depreciation rate per output unit may also be reduced if depreciation is charged depending on time, and not on production volume. As a result, the rate of variable costs per unit of production will be reduced due to its labor and depreciation components.

Also, with a significant increase in production volumes, the production waste volume, on which manual production can (and should) be organized, can increase. Thus, the so-called "returnable waste" will appear in the calculation of the main product, the cost of which is deducted from the production cost, and in this case, we will be able to observe a decrease in the rate of variable costs per output unit due to the material component.

To compose the formulas, we introduce the following notation:

V_0, V_1 – define the income or revenue from the activities of the enterprise of the base and reporting period, thousand rubles respectively;

Z_0, Z_1 – show the full cost of production, work, services of the enterprise of the base and reporting period, thousand rubles respectively;

P_0, P_1 – denote the profit from the activities of the enterprise of the base and reporting period, thousand rubles;

b – is the variable cost rate for 1 ruble of income or revenue, rub / rub;

a – is the total fixed costs, thousand rubles

We express revenue from the products sales, based on the fact that revenue is the production cost plus profit, the production cost is the sum of the fixed and variable costs, and the sum of the variable costs can be calculated as the variable costs' rate product for 1 ruble of revenue from the sales of products same revenue for the period. Let us compose a system of equations 1, expressing the revenue of the reporting and base period and using the proposed notation:

$$\begin{cases} V_0 = b * V_0 + a + P_0 \\ V_1 = b * V_1 + a + P_1 \end{cases} \tag{1}$$

Let us try to solve the proposed system of equations. If we subtract the second from the first equation, we can get rid of one unknown (formula 2):

$$\text{Rev}_{\text{basic}} - \text{Rev}_{rep} = b\big(\text{Rev}_{\text{basic}} - \text{Rev}_{\text{rep}}\big) + P_{\text{basic}} - P_{\text{rep}} \tag{2}$$

As it can be seen, we get an expression with one unknown and with the data that each company has at the end of the year. We derive a formula for calculating the rate of variable costs for 1 ruble of revenue:

$$b = \frac{V_0 - V_1 - P_0 + P_1}{V_0 - V_1} \tag{3}$$
$$\text{or}$$
$$b = \frac{(V_0 - P_0) - (V_1 - P_1)}{(V_0 - V_1)} \tag{4}$$

If to look carefully at the proposed formula, it is possible to see that in the numerator we have the difference between the cost of the basic period and the reporting one, because revenue minus profit is cost, and in the denominator, respectively, is the absolute revenue deviation. Simplifying the formula, we get the following:

$$b = \frac{\Delta Z}{\Delta V} \tag{5}$$

Further, having the full cost, revenue and variable cost rate for 1 ruble of revenue, we calculate the total fixed costs.

The proposed methodology is very similar to the Mini-Maxi method or the "high and low point method". However, the fundamental difference is as follows: the well-known Mini-Maxi method gives a possibility to determine the rate of variable costs per output unit in physical terms. It also requires the specific initial data on the output volume in physical terms, and not just for the year, for example, but on a monthly basis. Not every production can afford to keep a similar record due to its cost. In addition, there are such industries where it, is not possible in principle, for example, construction. Here it is completely unrealistic to calculate the sum of fixed and variable costs for each type of work without additional effort and the additional accounting introduction.

The proposed methodology can be used both for the current activities' analysis, and for forecast or planned costing.

Let us try to accommodate the proposed methodology on the construction industry LLC "SAP" enterprise example. For calculations, we take the report data on financial results for two periods. The source data for the calculations are shown in Table 1.

Table 1. Financial results of LLC "SAP", thousand rubles

Index	Period	
	2016	2017
Revenue	24053	23690
Total cost	20905	20645
Profit	3148	3045

The table shows the initial data necessary for the variables and fixed costs' allocation from the total cost when using the proposed methodology. This is quite accessible information available at each enterprise that does not require additional accounting and additional costs. The only assumption is that such information, of course, should be reliable, because only then it will be possible to rely on the results as reliable, in other words, it can be argued that the reliability and accuracy degree of the results is directly proportional to the reliability and accuracy degree of the source data, and also the degree of compliance with the above-mentioned conditions for the methodology application.

First of all, we will check whether the conditions limiting the possibility of applying the technique are met (Table 2).

Table 2. Calculation table for checking the conditions-assumptions of the methodology application

Index	Period, thousand rubles		Increase Rates, %
	basic	reporting	
Revenue	24053	23690	0,98
Total cost	20905	20645	0,99
Profit	3148	3045	0,96

The first condition is the possibility of comparing the levels used for calculating. In our case, the deviation of the reporting period from the base is 2%, which, according to the author, is quite real and quite acceptable.

The second condition: the production program structure should not be changed. In our example, there is a slight decrease in sales volumes, which is quite likely with identical production programs adopted in two periods. It is also possibly provided that the periods follow one another. This, according to the author, increases the production programs' identity possibility.

The third condition implies the compliance with the operating key factor rule. This means that profits should rise or decrease faster than the revenue. In our case, revenue decreases by 2%, and profit - by 4%. We can assume that this condition is also met.

We will carry out the calculations necessary for applying the methodology using Table 1 and summarize them in Table 3. To use formula 5, we calculate the absolute increase in revenue and cost indicators and add it to Table 3 (in italics).

Using formula 5, we calculate the rate of variable costs and add the results to Table 3 (in italics).

$$b = \frac{\Delta Z}{\Delta V} = \frac{-260}{-363} = 0,7162534435 \text{ rub/rub}$$

We calculate the variable costs' amount, multiplying the variable cost rate by 1 ruble of revenue by the revenue amount for the corresponding period, we will include the results in Table 3 (in italics).

We calculate the amount of fixed costs for the period, subtracting the sum of variable costs from the total cost, the results will be included in Table 3 (in italics). We get the amount of fixed costs, the same in two periods. This result can be interpreted as confirmation of the proposed methodology's applying possibility.

For additional verification, we perform the following steps. We calculate the fixed costs rate for 1 ruble of revenue by the ratio of the fixed costs amount to revenue, first in one period, then in the second. The results will be included in Table 3 (in italics). The fixed cost rate for 1 ruble of revenue increases along with the negative revenue dynamics, which reflects an adequate dynamic. Such a result can also be interpreted as confirmation of the applicability of the proposed methodology. Next, add up the fixed and variable cost rates for 1 ruble of revenue obtained using the proposed methodology. The results will be included in Table 3 (in italics). We also determine the cost of 1 ruble of revenue in the conventional manner, that is, using the cost ratio to revenue for the period. The results will be included in Table 3 (in italics). Let us compare the costs of 1 ruble of revenue obtained using the classical calculation and using the proposed method, we see a slight discrepancy, which, according to the author, may well be attributed to the error due to rounding.

Table 3. Calculation table for checking the proposed methodology's performance

Index	Period		*absolute increase*
	basic	reporting	
Revenues, thousand rubles	24053	23690	*-363*
The total cost, thousand rubles	20905	20645	*-260*
Profit, thousand rubles	3148	3045	*-260*
Variable cost rate for 1 ruble of revenue, rub / rub	*0,7162534435*	*0,7162534435*	*–*
Variable costs, thousand rubles	*17228*	*16968*	*-260*
Fixed costs, thousand rubles	*3677*	*3677*	*0*
Fixed cost rate for 1 ruble of revenue, rub / rub	*0,1528707438*	*0,1552131701*	*–*
The sum of the rates of fixed and variable costs for 1 ruble of revenue, rub / rub	*0,8691241873*	*0,8714666136*	*–*
Costs per 1 ruble of revenue, rub / rub	*0,8691223545*	*0,8714547531*	*–*

Let us draw up an algorithm for applying the proposed methodology for business entities, shown in Figure 1.
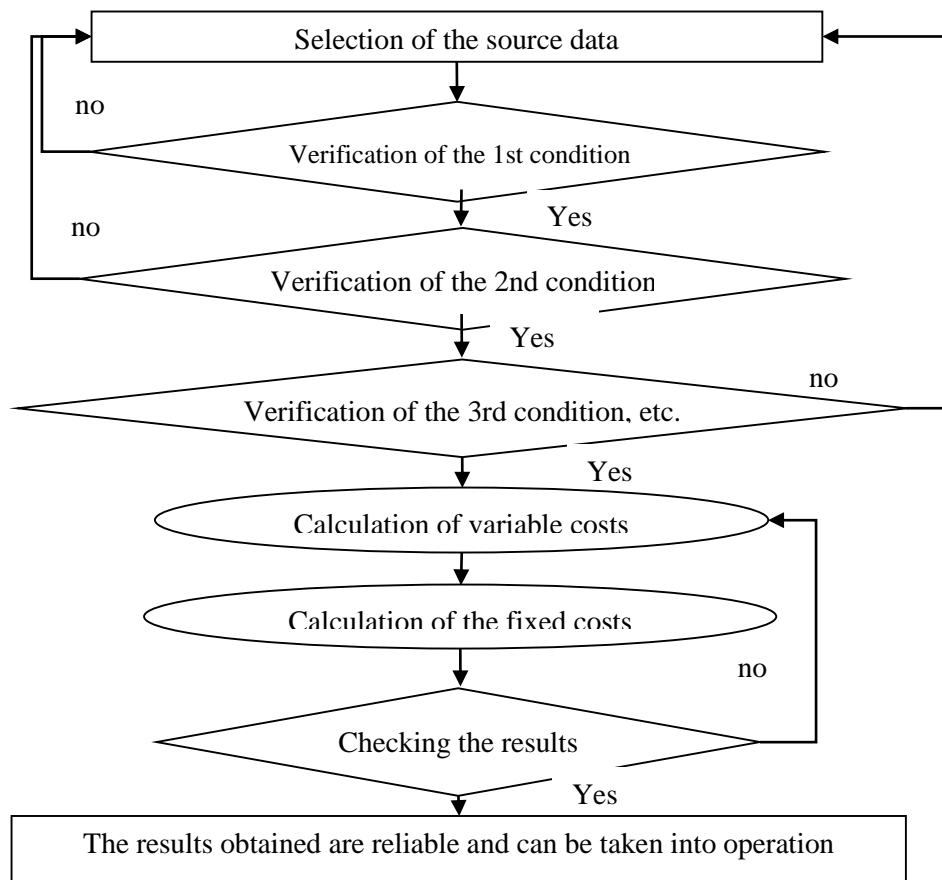
Figure 1. The algorithm for applying the proposed method for shearing the fixed and variable components from the total costs

Summary

Thus, the proposed methodology for the fixed and variable costs' allocation may well be considered operable and, according to the author, it can be recommended for the enterprises and organizations of any industry for use in the development of managerial decisions related to cost-management, it is a completed subject to the above-made assumptions.

The organizations' work effectiveness in the construction industry largely depends on the production process' cost reduction. Therefore, the formation of accounting and analytical information on construction costs in order to reduce its cost at the present stage is of great economic and social importance. Today, the level of competition in the construction market is so high that the owners and managers of economic entities are ready to use all possible means, methods and key factors that allow organizations to stay afloat. One of such methods can be called the use of price competitive advantages, allowing to reduce the price of construction products. Cost-management or cost management techniques that can not only control the costs of enterprises, but also significantly reduce them, can become an instrument for realizing such a competitive advantage for the construction industry.

The method proposed by the author will allow to obtain baseline information quickly and cheaply for the application of already known and approved cost-management techniques in order to reduce costs in any industrial direction, including the construction industry.

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