# Qualitative Substantiation of Strategic Decisions in the Field of Cost Management using the Methods of Economic Mathematical Modeling

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***Abstract* – The adoption of high-quality and balanced decisions in the field of cost management requires appropriate information and analytical support, and the possibility of prompt calculation of alternative variants with reference to predicted results. It was proposed to use the means of economic mathematical modeling to solve the problem of forming tools to improve information analytical support for the cost management, namely, the discrete multi-criteria optimization method with the subsequent development of an optimization model comprising information analytical support for cost management. In the process of developing the model, it was taken into account that from a formal point of view the configuration regardinginformation analytical support for cost management is optimized, and this implies an increase in the speed and quality of management decision-making with a sufficient level of reliability (validity) and minimization of costs. Accordingly, in order to build an optimality criterion, two minimization problems are solved in the corresponding optimization model, both of which comprises information and analytical support for cost management. As a result regarding application of the model, the optimal configuration of information analytical support for cost management is formed, which allows optimizing costs and improving the quality of management decisions.**

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## 1. Introduction

Today, it is virtually impossible to carry out a "manual" mode of good quality management within an enterprise. It is caused by changing situation in the economy, which is constantly altering and forming new challenges and threats. Accordingly, it is important for enterprise managers to respond quickly to changes and make up-to-date management decisions that are based on a high-quality information base using appropriate tools at this particular moment [3].

The means of the economic mathematical modeling are actively used as effective tools for solving many problems in modern studies within socio-economic systems and their elements [6], [9], [14]. However, their use in management requires considerable preparatory work and proper organization of the modeling process itself. First of all, when improving any processes or elements, tasks that must be solved with the maximum level of efficiency are formulated. Consequently, the modeling task can be formulated as follows: identifying qualitative analytical tools for managing costs, and finding out whether all or individual tools can be used within the framework of a chosen general instrumental approach in order to manage costs, and predicting the results of their use (increasing the level of efficiency and quality of management decisions, finding reserves to minimize costs).

## 2. Research Method

At the heart of the process of improving information analytical support for cost management (IASCM) are flows of internal and external information on cost formation. From a formal point of view, the IASCM configuration is optimized. With minor simplifications in practice, such optimization gives efficiency and quality of decision-making management with a sufficient level of reliability (validity) and minimization of costs. Therefore, two minimization problems are designated as the basis for constructing an optimality criterion in the corresponding IASCM optimization model [11], [15]:

$$x^* \in \arg\min_{x\in S} s_{IASCM}(x) \quad , \qquad (1)$$

$$y^* \in \arg\min_{y\in T} \theta_{IASCM}(y) \quad , \qquad (2)$$

in which the following conventions are relative to variables:

$s_{IASCM}(x)$ – A function whose value corresponds (is equal) to standardized costs;

$\theta_{IASCM}(y)$ – A function, whose value characterizes the efficiency of making management decisions with a sufficient level of reliability (validity);

$x$ – A set of parameters or factors that indirectly or directly affect the resulting costs;

$y$ – A set of parameters or factors that indirectly or directly affect the efficiency of making management decisions with a sufficient level of reliability (validity);

$S$ – A set of all possible (permissible) factors influencing the resulting costs;

$T$ – The set of all possible (permissible) IASCM parameters related to the speed of making management decisions.

Let us proceed to the analysis of tasks (1) and (2). If $S\cap T=\varnothing$, task (1) and (2) would be solved separately, , using classical approaches. However, it is obvious that $S\cap T \neq \varnothing$, since the efficiency of making management decisions with a sufficient level of reliability is actually related to time costs. In other words, the sets $S$ and $T$ have a number of common elements, because they are formed with the same internal and external information flows, and the both have common characteristics. This combines the described sets.

Therefore, tasks (1) and (2) are a two-criterion optimization problem. Taking into account the condition that $S\cap T\neq\varnothing$, for its correct representation instead of two separate sets $S$ and $T$, we will consider the set $U = S \cup T$. On the set $U$ functions $s_{IASCM}(x)$ and $\theta_{IASCM}(y)$ do not change – only their arguments (configuration IASCM) will have a greater number of elements in the list. This very list will be common to both functions. Let us note it $z$, in which $z \in U$. The list of arguments $z$ includes both list $x$ and list $y$. Then we formally get such a two-criteria optimization problem [1], [8]:

$$z^* \in \arg\min_{z\in U} s_{IASCM}(z) \quad ; \qquad (3)$$

$$z^* \in \arg\min_{z\in U} \theta_{IASCM}(z) \quad . \qquad (4)$$

Problem (3) and (4) in the general case will be represented in the form of sections regarding the corresponding subsets of the set $U$:

$$z^* \in \left\{ \arg\min_{z\in U} s_{IASCM}(z)\right\} \cap \left\{\arg\min_{z\in U} \theta_{IASCM}(z)\right\} . \qquad (5)$$

It is known that multi-criteria problems very rarely have a solution. This applies even to the tasks with a minimum number of criteria like two-criteria. Therefore, the two-criteria problem (5) should be reduced to an equivalent single-criteria (scalar) problem or to some sequence of scalar problems [12].

Now we proceed to the evaluation of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$. To do this, we first define the structure of the set U. This set contains all possible, accessible, and acceptable IASCM configurations. In this case, we note that the number of basic methods of cost management and their information analytical support is not limited to the list of 11 most common methods (1. Absorption Costing, 2. Direct Costing System, 3. Standard Costing System, 4. Activity Based Costing, 5. Cost – Volume-Profit, 6. Life Cycle Costing, 7. Killing Costing, 8. Benchmarking, 9. Value Chain Costing, 10. Target Costing, 11. Kaizen Costing) and number the first 11 elements of the set $U$ from 1 to 11. That is, $z_1 \in U$ corresponds to absorption-costing, $z_2 \in U$ corresponds to direct-costing, etc. Therefore, the list of methods is a subset $\{z_j\}_{j=1}^{11} \subset U$ .

Consequently, the set of all IASCM configurations is $U = \{z_j\}_{j=1}^{M}$, in which the number is:

$$M \le \sum_{m=1}^{11} \frac{11!}{m!\cdot(11-m)!} = 2047 .$$

The maximum number of combined methods is 2047 - 11 = 2036. Therefore, optimization on a finite set according to the statement of problem (5) will not be a trivial overview or a construction of the Pareto set [13].

Thus, the functions $s_{IASCM}(z)$ та $\theta_{IASCM}(z)$ should be evaluated by M variants using the list of parameters and factors that indirectly or directly affect the resulting costs, and the efficiency of the management decision with a sufficient level of reliability. Of course, some part of these options cannot be estimated without additional expertise (expert procedures). So we can assume that in order to evaluate $M_0$ of $M$ values in each of the functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$, it is necessary to apply expert methods. Obviously that $M_0< M$, but in practice the value $M_0$ is up to 50% of the value $M$. Set $M_0$ estimates of functions are determined on a subset $U_0 \subset U = \{z_j\}_{j=1}^{M}$.

Before proceeding to the formalization of the processing comprising expert estimations, we can describe the procedure for the normalization of functions $s_{IASCM}(z)$ та $\theta_{IASCM}(z)$, since units of measurement of their values in the general case are different. Furthermore, we can assume that functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ are already estimated. Expert estimations are represented and processed by the analysis of hierarchies using matrices of pairwise comparisons [7]. At the same time, they have values that are strictly less than one:

$$s_{IASCM}(z)<1 \text{. } \forall z \in U_0 \subset U \text{ and}$$
$$\theta_{IASCM}(z)<1 \text{. } \forall z \in U_0 \subset U \text{ ,}$$

since the values of the evaluated functions in a subset $U_0 \subset U$ will be equal to priorities.

Exactly after using the hierarchy analysis method based on the matrices of the pairwise comparison of the function $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$, in a subset $U_0 \subset U$ will not be normalized yet, and functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ estimated on a subset $\{U \setminus U_0\} \subset U$ may have values greater than one. To be more precise, after processing expert estimations and prioritization, we obtain a set of dimensionless quantities:

$$0< \min_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(z)< \max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(z)<1$$

and

$$0< \min_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(z)< \max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(z)<1$$

However, the maximum values

$$\max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(z) \text{ and } \max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(z)$$

do not necessarily have to coincide, usually they are different:

$$\max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(z) \neq \max_{z\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(z) \text{ . (6)}$$

Condition (6) indicates that the valuation is incorrect even in the subset $U_0 \subset U$. Rationing is fundamentally necessary for solving any task of multi-criteria optimization [12].

Then instead of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ we will consider the normalized functions:

$$\tilde{s}_{IASCM}(z) \text{ and } \tilde{\theta}_{IASCM}(z), \quad (7)$$

defined on the same set. Obviously, at first glance, it would be rationing of this type:

$$\tilde{s}_{IASCM}(z)=\frac{s_{IASCM}(z)}{\max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(h)} \quad (8)$$

$$\tilde{\theta}_{IASCM}(z)=\frac{\theta_{IASCM}(z)}{\max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(h)} \text{ . (9)}$$

However, the rationing (8) and (9) occurs only within the limits of costs or the speed of making managerial decisions. Therefore, the rationing of type (8) and (9) is unacceptable. For example, if:

$$\max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(h)< \max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(h) \text{ ,}$$

this means that the impact of IASCM configuration options on costs is more significant than their impact on the efficiency regarding making managerial decisions. But after the valuation of formulas (8) and (9), this fact disappears, since it will be:

$$\max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \tilde{s}_{IASCM}(h)=1$$
$$\max_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \tilde{\theta}_{IASCM}(h)=1 \text{ .}$$

Consequently, instead of rationing (8) and (9) we should perform the rationing of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ in a subset $U_0 \subset U$ by the following approach:

$$\tilde{s}_{IASCM}(z)=\frac{s_{IASCM}(z)}{\max\left\{\max\limits_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(h),\ \max\limits_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(h)\right\}},\ z\in U_0\subset U \tag{10}$$

$$\tilde{\theta}_{IASCM}(z)=\frac{\theta_{IASCM}(z)}{\max\left\{\max\limits_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} s_{IASCM}(h),\ \max\limits_{h\in U_0\subset U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(h)\right\}},\ z\in U_0\subset U \tag{11}$$

The rationing of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ in a subset $\{U/U_0\}\subset U$ we do the same:

$$\tilde{s}_{IASCM}(z)=\frac{s_{IASCM}(z)}{\max\left\{\max\limits_{h\in\{U/U_0\}\subset U} s_{IASCM}(h),\ \max\limits_{h\in\{U/U_0\}\subset U} \theta_{IASCM}(h)\right\}},\ z\in\{U/U_0\}\subset U \tag{12}$$

$$\tilde{\theta}_{IASCM}(z)=\frac{\theta_{IASCM}(z)}{\max\left\{\max\limits_{h\in\{U/U_0\}\subset U} s_{IASCM}(h),\ \max\limits_{h\in\{U/U_0\}\subset U} \theta_{IASCM}(h)\right\}},\ z\in\{U/U_0\}\subset U \tag{13}$$

As soon as the functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ are evaluated and conditioned by the relations (10) – (13), we turn to the solution of the two-criteria problem (5), which will take the following form:

$$z^*\in\left\{\arg\min_{z\in U=\{z_j\}_{j=1}^{M}} \tilde{s}_{IASCM}(z)\right\}\cap\left\{\arg\min_{z\in U=\{z_j\}_{j=1}^{M}} \theta_{IASCM}(z)\right\} \tag{14}$$

Given that, there is no exact solution to the problem (14), and we will seek a compromise solution. We can consider possible options for a compromise, which is one way or another connected with the task scalarization. Before proceeding directly to the implementation of scalarization, we consider the possibility of minimax solving the two-criterion problem (14). By minimax approach, solving this problem (14) leads us to find the minimum rationing costs (losses) in the most adverse conditions [5]:

Considering that there is no exact solution to problem (14), we will look for a compromise solution.

$$z^*\in\arg\min_{z\in U=\{z_j\}_{j=1}^{M}}\left(\max\left\{\max_{z\in U=\{z_j\}_{j=1}^{M}} \tilde{s}_{IASCM}(z),\ \max_{z\in U=\{z_j\}_{j=1}^{M}} \tilde{\theta}_{IASCM}(z)\right\}\right) \tag{15}$$

The problem (15) always has a solution. However, it is usually too pessimistic, focusing solely on the adverse circumstances of choosing a common instrumental approach to cost management and the inability to predict the outcome for applying this approach. As some alternative to the minimax approach, an approach with minimizing losses by the regret aversion can be used [10]. For this functions $\tilde{s}_{IASCM}(z)$ and $\tilde{\theta}_{IASCM}(z)$ turn into functions:

$$\beta(z)=\tilde{s}_{IASCM}(z)-\min_{h\in U\{z_j\}_{j=1}^{M}} \tilde{s}_{IASCM}(h) \quad \text{when } z\in U=\{z_j\}_{j=1}^{M} \tag{16}$$

$$\psi(z)=\tilde{\theta}_{IASCM}(z)-\min_{h\in U\{z_j\}_{j=1}^{M}} \tilde{\theta}_{IASCM}(h) \quad \text{when } z\in U=\{z_j\}_{j=1}^{M} \tag{17}$$

New functions (16) and (17) are, in fact, fines (losses) arising from the non-optimal (non-rational) choice of IASCM configuration options. Further, according to the regret aversion, we already have a "softened" minimax:

$$z^*\in\arg\min_{z\in U=\{z_j\}_{j=1}^{M}}\left(\max\left\{\max_{z\in U=\{z_j\}_{j=1}^{M}} \beta(z),\ \max_{z\in U=\{z_j\}_{j=1}^{M}} \psi(z)\right\}\right) \tag{18}$$

Minimax (18), however, remains a rough approximation to the solution of the problem (14), and it is applicable in practically the same conditions as the minimax (15).

In the end, we can consider directly the scalarization of the two-criterion problem (14). It can be performed in one or in two stages. Two-step scalarization is equivalent to the well-known method of successive assignments. To use this method, the decision maker must determine the order of importance of the functions $\tilde{s}_{IASCM}(z)$ and $\tilde{\theta}_{IASCM}(z)$. Let the function of normalized costs $\tilde{s}_{IASCM}(z)$ be more important than the function of normalized efficiency of making managerial decisions $\tilde{\theta}_{IASCM}(z)$. Then, for the task to minimize these two functions, the following should be done.

First, the most important task is solved. Accordingly, function $\tilde{s}_{IASCM}(z)$ is minimized:

$$z_1^*(\tilde{s}) = \min_{z\in U=\{z_j\}_{j=1}^M} \tilde{s}_{IASCM}(z) \quad . \quad (19)$$

In the second step, from practical considerations and accepted accuracy, the assignment is determined $\Delta z_1(\tilde{s})$, in which $\Delta z_1(\tilde{s})>0$ is the magnitude by which the achieved value increases $z_1^*(\tilde{s})$ to more important function than normalized costs. Due to this assignment, we are trying, as far as possible, to reduce the importance of the second most important function of the normalized efficiency of decision-making management $\tilde{\theta}_{IASCM}(z)$.

The least value:

$$z_2^*(\tilde{s},\tilde{\theta}) = \min_{\substack{z\in U=\{z_j\}_{j=1}^M \\ \tilde{s}_{IASCM}(z)\le z_1^*(\tilde{s})+\Delta z_1(\tilde{s})}} \theta_{IASCM}(z) \quad (20)$$

approximately is a simultaneous minimum of functions $\tilde{s}_{IASCM}(z)$ and $\tilde{\theta}_{IASCM}(z)$, which corresponds to an approximate solution of the problem (14):

$$z^* \in \arg = \left\{ \min_{\substack{z\in U=\{z_j\}_{j=1}^M \\ \tilde{s}_{IASCM}(z)\le z_1^*(\tilde{s})+\Delta z_1(\tilde{s})}} \theta_{IASCM} \right\}(z) \quad . \quad (21)$$

With such two-step optimization, the solution of problem (21) is quite effective. However, before unleashing it is necessary to determine the most important function, for which expert estimations are needed. In addition, to determine and justify the assignment $\Delta z_1(\tilde{s})$ or $\Delta z_1(\tilde{\theta})$ the expertise is also necessary. Such a two-step expert procedure is not profitable, since it slows down the process of obtaining a solution - efficiency is already lost by itself. Therefore, for the effective solution of the two-criterion problem (14) we will construct a scalar problem. Scalarisation is performed with some (usually normalized) weights (coefficients of relative importance or significance), in which each weight is multiplied by its function. Since we have only two functions, then we will have two weights. But due to the fact that the combination of functions will be convex, the sum of these weights is single. So the weight of the function $\tilde{s}_{IASCM}(z)$ is marked as $\alpha(\tilde{s})$. Then the weight of the function $\tilde{\theta}_{IASCM}(z)$ is equal to $1-\alpha(\tilde{s})$.

We continue to minimize the combined function:

$$\mu(z) = \alpha(\tilde{s})\cdot \tilde{s}_{IASCM}(z) + \left[1-\alpha(\tilde{s})\right]\cdot \tilde{\theta}_{IASCM}(z) \quad (22)$$

in a set $z\in U=\{z_j\}_{j=1}^M$. Then the approximate solution of problem (14) will be the exact solution of the problem:

$$z_1^* \in \arg \min_{z\in U=\{z_j\}_{j=1}^M} \mu(z) \quad , \quad (23)$$

in which the function (22) will be used.

Weight $\alpha(\tilde{s})$ is usually determined by an expert method. Thus, before the direct solving of the problem (23) with function (22), we need to perform the following three actions:

1) to evaluate the values of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ in a subset $U_0 \subset U$ and in a subset $\{U/U_0\}\subset U$;

2) to perform rationing of evaluated functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ by correlation (10) – (13);

3) to evaluate the weight $\alpha(\tilde{s})$ for assembling the function (22).

We can take a look at the first and last steps in more detail. To evaluate the values of functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ in a subset $U_0 \subset U$ it is expedient to use the hierarchy analysis method with matrices of pairwise comparison [2]. These matrices have a format $M_0\times M_0$. However, if $M_0>15$, the application of the hierarchy analysis method is problematic [7]. Therefore, under condition $M_0>15$ these $M_0$ of $z$ sets, we divide into groups with no more than 15 subsets. For each of them we will conduct expert evaluations.

Let $M_0$ variants of $z$ sets are numbered as $\left\{z_{j_m}\right\}_{m=1}^{M_0}=U_0\subset U$. We denote the matrix of pairwise comparisons for the evaluation of function $s_{IASCM}\left(z\right)$ from $i$-th expert as $\mathrm{S}_i=\left[s_{mn}^{(i)}\right]_{M_0\times M_0}$, and for the evaluation of function $\theta_{IASCM}\left(z\right)$ as $\Theta_i=\left[\theta_{mn}^{(i)}\right]_{M_0\times M_0}$. These matrices are positive inverse-symmetric matrices and have the following properties:

$$s_{mn}^{(i)}=\frac{1}{s_{nm}^{(i)}} \text{ and } \theta_{mn}^{(i)}=\frac{1}{\theta_{nm}^{(i)}} \text{ when } m=\overline{1,M_0} \text{ and } n=\overline{1,M_0}, \tag{24}$$

moreover:

$$s_{mm}^{(i)}=1 \text{ та } \theta_{mm}^{(i)}=1.\ \forall m=\overline{1,M_0}. \tag{25}$$

According to the standards of the hierarchy analysis method regarding the elements of the matrix comprising pairwise comparisons, each expert gives an expert judgment, which is a positive integer or fractional number. There are a total of 17 variants of such judgments. The ratio between the influence of $m$-and $n$-th IASCM configuration options on costs and efficiency of decision-making management is assessed according to the following scale:

1) The value of an element ($m.n$) of matrices of pairwise comparisons is equal to 1, if influence of $m$-th and $n$-th IAЗУВ configuration options are the same;
2) The value of an element ($m.n$) of matrices of pairwise comparisons is equal to 3, if $m$-th IASCM configuration option is slightly more useful, than $n$-th option;
3) The value of an element ($m.n$) of matrices of pairwise comparisons is equal to 5, if $m$-th IASCM configuration option is much more useful, than $n$-th options;
4) The value of an element ($m.n$) of matrices of pairwise comparisons is equal to 7, if $m$-th IASCM configuration option is obviously more useful, than $n$-th option;
5) The value of an element ($m.n$) of matrices of pairwise comparisons is equal to 9, if $m$-th IASCM configuration option is absolutely prevails $n$-th option.

Numbers 1, 3, 5, 7, 9 and their inverse quantities are the basic numerical estimates of expert estimations. Numbers 2, 4, 6, 8 and their inverse values are used to facilitate the compromises between expert estimations, which differ from the basic estimation numbers [7]. Thus, according to the described scale of expert assessments:

$$s_{mn}^{(i)}\in\left\{\frac{1}{9},\frac{1}{8},\frac{1}{7},\frac{1}{6},\frac{1}{5},\frac{1}{4},\frac{1}{3},\frac{1}{2},1,2,3,4,5,6,7,8,9\right\},$$
$$\theta_{mn}^{(i)}\in\left\{\frac{1}{9},\frac{1}{8},\frac{1}{7},\frac{1}{6},\frac{1}{5},\frac{1}{4},\frac{1}{3},\frac{1}{2},1,2,3,4,5,6,7,8,9\right\}$$
$$\forall m=\overline{1,M_0} \text{ and } \forall n=\overline{1,M_0} \text{ with } i=\overline{1,N}, \tag{26}$$

in which number $N$ is the total number of experts involved.

The current task is to determine the relative priorities among $M_0$ IASCM configuration option $\left\{z_{j_m}\right\}_{m=1}^{M_0}=1$. The priority of $m$-th option we denote as $p_m$, when the sum of all priorities is single:

$$\sum_{m=1}^{M_0}p_m=1. \tag{27}$$

However, the priorities $\left\{p_m\right\}_{m=1}^{M_0}$ are determined by a single (generalized) matrix of pairwise comparisons. Therefore, the next task arises – the averaging of expert opinions. It is actually about averaging expert matrices $\left\{\mathrm{S}_i=\left[s_{mn}^{(i)}\right]_{M_0\times M_0}\right\}_{i=1}^{N}$ and $\left\{\Theta_i=\left[\theta_{mn}^{(i)}\right]_{M_0\times M_0}\right\}_{i=1}^{N}$.

First, we note that when forming expert groups, it is not often possible to select experts for the same (identical) level of professionalism. Therefore, in order to distinguish experts by different levels of their professionalism (competence) or experience, we denote the weight (indicator) of the competence of the $i$-th expert as $\xi_i$ [10]. Of course, weight $\xi_i\in(0;1)$, with $\sum_{i=1}^{N_0}\xi_i=1$.

The set of all positive inverse-symmetric matrices $M_0$-*th* order is denoted by $B(M_0)$. We can choose two arbitrary elements (matrixes) of space $B(M_0)$. We can also choose two arbitrary elements (matrices) of space $B(M_0)$:

$$\mathrm{A}=\left[a_{mn}\right]_{M_0\times M_0}\in B(\mathrm{M}_0),$$
$$\mathrm{B}=\left[b_{mn}\right]_{M_0\times M_0}\in B(\mathrm{M}_0).$$

We introduce the distance on the set (in space) $B(M_0)$ between matrices A and B, and denote it by $d_{B(M_0)}(\mathrm{A,B})$. We calculate this distance by analogy with the usual Euclidean distance [4]:

$$d_{B(M_0)}(\mathrm{A,B}) = \|\mathrm{A\text{-}B}\| = \sqrt{\sum_{m=1}^{M_0}\sum_{n=1}^{M_0}(a_{mn} - \mathrm{b}_{mn})^2} \quad (28)$$

In order to speed up the computational procedures, we use the property of the inverse symmetry of matrices A and B. Then we simplify formula (28) to the form, even without considering that the main diagonal under the sign of the square root will be less than half the parts:

$$d_{B(M_0)}(\mathrm{A,B}) = \|\mathrm{A\text{-}B}\| = \sqrt{\sum_{m=1}^{M_0-1}\sum_{n=m+1}^{M_0} 1 + (a_{mn}\mathrm{b}_{mn})^2 \cdot \frac{(a_{mn} - b_{mn})^2}{(a_{mn}b_{mn})^2}} \quad (29)$$

In the future, to perform calculations of the distance between the space $B(M_0)$ matrices, we will use the formula (29).

Note that the set $B(M_0)$ contains an infinite number of positive inverse-symmetric matrices, whose elements can be exclusively fractional or irrational numbers:

$$B(M_0) = \left\{ \mathrm{A} = [a_{mn}]_{M_0\times M_0} : a_{mn} > 0, a_{mm} = 1 \forall m = \overline{1, M_0}, a_{mn} = \frac{1}{a_{nm}} \right\}$$

In this case, the matrices $\left\{ \mathrm{S}_i = \left[ s_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N}$ and $\left\{ \Theta_i = \left[ \theta_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N}$ belong to a subset of the space $B(M_0)$, in which the elements of each matrix satisfy condition (26). We denote this subset this way:

$$\overline{B}_9(M_0) = \left\{ \mathrm{A} = [a_{mn}]_{M_0\times M_0} : a_{mn} \in \left\{ a, \frac{1}{a} \right\}_{a=1}^{9} \right\} \subset B(M_0) \quad (30)$$

The set (30) consists only of matrices of pairwise comparisons. It is obviously finite. Let the set (30) consist of all $Q$ matrices of pairwise comparisons. The choice of the averaged matrix of pairwise comparisons must be made exactly in the set (30) of $Q$ matrices of pairwise comparisons:

$$\left\{ \mathrm{A}_q = \left[ a_{mn}^{(q)} \right]_{M_0\times M_0} \right\}_{q=1}^{Q} = \overline{B}_9(M_0) \subset B(M_0).$$

It is obvious that the groups of expert matrices form a subset of the set $\overline{B}_9(M_0)$:

$$\left\{ \left\{ \mathrm{S}_i = \left[ s_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N}, \left\{ \Theta_i = \left[ \theta_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N} \right\} \subset \overline{B}_9(M_0) \subset B(M_0)$$

The distance between the matrix $\mathrm{A}_q = \left[ a_{mn}^{(q)} \right]_{M_0\times M_0}$ and the group of expert matrices of pairwise comparisons $\left\{ \mathrm{S}_i = \left[ s_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N}$ and $\left\{ \Theta_i = \left[ \theta_{mn}^{(i)} \right]_{M_0\times M_0} \right\}_{i=1}^{N}$ we determine by formulas:

$$\rho\left(\mathrm{A}_q, \{\mathrm{S}_i\}_{i=1}^{N}\right) = \sum_{i=1}^{N} \xi_i \cdot d_{B(\mathrm{M}_0)}\left(\mathrm{A}_q, \mathrm{S}_i\right), \quad q = \overline{1,Q}, \quad (31)$$

$$\rho\left(\mathrm{A}_q, \{\Theta_i\}_{i=1}^{N}\right) = \sum_{i=1}^{N} \xi_i \cdot d_{B(\mathrm{M}_0)}\left(\mathrm{A}_q, \Theta_i\right), \quad q = \overline{1,Q} \quad (32)$$

The smallest distance among Q possible distances (31) corresponds to the desired averaged matrix of pairwise comparisons:

$$\mathrm{S} = [s_{mn}]_{M_0\times M_0} \in \overline{B}_9(M_0) \subset B(M_0) \quad (33)$$

as for the effect of $M_0$ IASCM configuration options on costs. This matrix (33) is determined by the solution of a simple minimization problem:

$$\mathrm{S} = [s_{mn}]_{M_0\times M_0} \in \arg\left\{ \min_{\substack{\mathrm{A}_q\ \overline{B}_9(M_0) \subset \overline{B}(M_0) \\ q=\overline{1,Q}}} \rho\left(\mathrm{A}_q, \{\mathrm{S}_i\}_{i=1}^{N}\right) \right\} \quad (34)$$

The desired averaged matrix of pairwise comparisons:

$$\Theta = [\theta_{mn}]_{M_0\times M_0} \in \overline{B}_9(M_0) \subset B(M_0) \quad (35)$$

as for the effect of $M_0$ IASCM configuration options on the efficiency of the management decision making with a sufficient level of reliability is determined similarly:

$$\Theta = [\theta_{mn}]_{M_0\times M_0} \in \arg\left\{ \min_{\substack{\mathrm{A}_q\ \overline{B}_9(M_0) \subset \overline{B}(M_0) \\ q=\overline{1,Q}}} \rho\left(\mathrm{A}_q, \{\Theta_i\}_{i=1}^{N}\right) \right\} \quad (36)$$

Ensuring matrices (34) and (36), we can already determine the corresponding priorities $p_m(\mathrm{S})$ and $p_m(\Theta)$ according to the following scheme:

$$\tilde{p}_m(S) = \left(\prod_{n=1}^{M_0} s_{mn}\right)^{\frac{1}{M_0}}, \quad \tilde{p}_m(\Theta) = \left(\prod_{n=1}^{M_0} \theta_{mn}\right)^{\frac{1}{M_0}}, \quad (37)$$

$$p_m(S) = \frac{\tilde{p}_m(S)}{\sum_{n=1}^{M_0} \tilde{p}_n(S)}, \quad p_m(\Theta) = \frac{\tilde{p}_m(\Theta)}{\sum_{n=1}^{M_0} \tilde{p}_n(\Theta)}, \quad m = \overline{1, M_0} \quad (38)$$

From formulas (38) it follows that the condition (27) for the priorities is fulfilled: $p_m(\mathbf{S}) > 0$, $p_m(\Theta) > 0$, with $\sum_{m=1}^{M_0} p_m(S) = 1$ and $\sum_{m=1}^{M_0} p_m(\Theta) = 1$.

Having determined the priorities (38), we evaluate matrix S consistency and matrix Θ consistency. To do this, we calculate their maximum eigenvalues:

$$\lambda_{\max}(S) = \sum_{m=1}^{M_0}\sum_{n=1}^{M_0} s_{mn} \cdot p_m(S),$$
$$\lambda_{\max}(\Theta) = \sum_{m=1}^{M_0}\sum_{n=1}^{M_0} \theta_{mn} \cdot p_n(\Theta). \quad (39)$$

In case of good matrix **S** consistency, $\lambda_{\max}(S)$ consistency is close enough to $M_0$. $\lambda_{\max}(\Theta)$ consistency has to be close enough to $M_0$ as well, causing satisfactory matrix Θ consistency.

To check the consistency, we calculate the consistency index:

$$I_{cons}(S) = \frac{\lambda_{\max}(S) - M_0}{M_0 - 1},$$
$$I_{cons}(\Theta) = \frac{\lambda_{\max}(\Theta) - M_0}{M_0 - 1},$$

and find the consistency relation:

$$r_{cons}(S) = \frac{I_{cons}(S)}{I_{M_0}}, \quad r_{cons}(\Theta) = \frac{I_{cons}(\Theta)}{I_{M_0}},$$

in which $I_{M_0}$ is an average random index for a positive inverse-symmetric matrix of order $I_{M_0}$. Index $I_{M_0}$ is taken from a well-known table of such indices with $M_0 = \overline{2,15}$. Satisfactory consistency of the matrix of pairwise comparisons [7] corresponds to expert estimations, in which

$r_{cons}(S) \le 0.1$, $r_{cons}(\Theta) \le 0.1$.

In the case of good matrix *S* consistency by the function estimate $s_{IASCM}(z)$ at the point $z = z_{j_m}$ is prior $p_m(S)$:

$$s_{IASCM}(z_{j_m}) = p_m(S) \quad \forall_m = \overline{1, M_0}. \quad (40)$$

In case of unsatisfactory matrix S consistency, we will conduct revaluations. Similarly, in the case of good matrix Θ consistency with function $\theta_{IASCM}(z)$ estimation at the point $z = z_{j_m}$ is prior $p_m(\Theta)$:

$$\theta_{IASCM}(z_{j_m}) = p_m(\Theta) \quad \forall_m = \overline{1, M_0}. \quad (41)$$

We note that what accepted (40) is, must not necessarily follow equity (41) and vice versa. In other words, the matrices S and Θ consistency are not related to each other.

Before final accepting evaluations of functions $s_{IASCM}(z)$ i $\theta_{IASCM}(z)$, expert matrices of pairwise comparisons $\left\{S_i = \left[s_{mn}^{(i)}\right]_{M_0 \times M_0}\right\}_{i=1}^{N}$ and $\left\{\Theta_i = \left[\theta_{mn}^{(i)}\right]_{M_0 \times M_0}\right\}_{i=1}^{N}$ should be checked for consistency. Testing this type of consistency involves comparing with another method for determining the averaged matrix of pairwise comparisons. According to this method, the elements of the averaged matrix of pairwise comparisons are found as the geometric mean of the elements regarding the expert matrices. Accordingly, an analogue of the matrix *s* is matrix $\tilde{S} = \left[\tilde{s}_{mn}\right]_{M_0 \times M_0}$ with:

$$\tilde{s}_{mn} = \left(\prod_{i=1}^{N} s_{mn}^{(i)}\right)^{\frac{1}{N}}, \quad m = \overline{1, M_0}, \quad n = \overline{1, M_0}.$$

The matrix of pairwise comparisons of variants of influence on the efficiency of making managerial decisions $\tilde{\Theta} = \left[\tilde{\theta}_{mn}\right]_{M_0 \times M_0}$ is determined the same way, in which:

$$\tilde{\theta}_{mn} = \left(\prod_{i=1}^{N} \theta_{mn}^{(i)}\right)^{\frac{1}{N}}, \quad m = \overline{1, M_0}, \quad n = \overline{1, M_0}.$$

If the matrices $\tilde{S}$ and S, are being elements of the sets *B(M₀)* and (30), respectively, and are close enough in the sense of distance (29), then function $s_{IASCM}(z)$ is estimated by the corresponding priorities (40). Here, sufficient proximity is understood as follows.

The matrix from space $B(M_0)$ is sufficiently close to the matrix from the subset (30), if the distance between them is 5 to 10% of the maximum distance between the matrices of the subset (30) and the matrix $\tilde{S}$. The distance between the matrices $\tilde{\Theta}$ and Θ is interpreted the same way. So, if the inequality is fulfilled:

$$d_{B(M_0)}\left(\tilde{S},S\right) < 0.1 \max_{\substack{A_q \in \bar{B}_9(M_0) \subset B(M_0) \\ q=\overline{1,Q}}} d_{B(M_0)}(A_q,\tilde{S}) \quad (42)$$

then function $s_{IA3VB}(z)$ is evaluated in accordance with (40), otherwise – it is necessary to repeat the expert procedure. Similarly, if inequality is performed:

$$d_{B(M_0)}\left(\tilde{\Theta},\Theta\right) < 0.1 \max_{\substack{A_q \in \bar{B}_9(M_0) \subset B(M_0) \\ q=\overline{1,Q}}} d_{B(M_0)}(A_q,\tilde{\Theta}) \quad (43)$$

then function $\theta_{IASCM}(z)$ is evaluated in accordance with (41).

If the inequality (43) is not fulfilled, it is necessary to repeat the expert procedure.

As soon as the values of the functions $s_{IASCM}(z)$ and $\theta_{IASCM}(z)$ are evaluated, we carry out their rationing by the relations (10) – (13). After this step, we still have to estimate the weight $\alpha(\tilde{s})$ for the function (22).

For such expert estimation the matrix of pairwise comparisons will be primitive.

Let $\left\{W_i = \left[s_{mn}^{(i)}\right]_{2\times 2}\right\}_{i=1}^{N}$ be the set of expert matrices of pairwise comparisons, in which the importance of the functions $\tilde{s}_{IASCM}(z)$ and $\tilde{\theta}_{IASCM}(z)$ is estimated.

Here is generalized 2×2 matrix of pairwise comparisons:

$$W = \left[w_{mn}\right]_{2\times 2} \in \arg\left\{\min_{\substack{A_q \in \bar{B}_9(2) \subset B(2) \\ q=\overline{1,Q}}} \rho\left(A_q,\{W_i\}_{i=1}^{N}\right)\right\} \quad (44)$$

in which

$$\rho\left(A_q,\{W_i\}_{i=1}^{N}\right) = \sum_{i=1}^{N} \zeta_i \cdot d_{B(2)}\left(A_q, W_i\right), \quad q=\overline{1,Q}. \quad (45)$$

Having received the matrix (3.44), we define two priorities, $p_1(W)$ and $p_2(W)$, in which the priority $p_1(W)$ corresponds to weight $\alpha(\tilde{s})$, and the priority $p_2(W)$ – to weight $1-\alpha(\tilde{s})$:

$$p_1(\mathbf{W}) = \frac{\sqrt{w_{11}\cdot w_{12}}}{\sqrt{w_{11}\cdot w_{12}}+\sqrt{w_{21}\cdot w_{22}}} = \frac{\sqrt{w_{12}}}{\sqrt{w_{12}}+\sqrt{w_{21}}} = \frac{\sqrt{w_{12}}}{\sqrt{w_{12}}+\frac{1}{\sqrt{w_{12}}}} = \frac{w_{12}}{w_{12}+1} \quad (46)$$

$$p_2(\mathbf{W}) = \frac{\sqrt{w_{21}\cdot w_{22}}}{\sqrt{w_{11}\cdot w_{12}}+\sqrt{w_{21}\cdot w_{22}}} = \frac{w_{21}}{w_{21}+1} = \frac{1}{w_{12}+1}.$$

Having determined the priorities (46), we estimate the consistency of the matrix (44), for which we calculate its maximum eigenvalue:

$$\lambda_{\max}(\mathbf{W}) = \sum_{m=1}^{2}\sum_{n=1}^{2} w_{mn}\cdot p_n(\mathbf{W}) =$$
$$= w_{11}\cdot\frac{w_{12}}{w_{12}+1} + w_{12}\cdot\frac{1}{w_{12}+1} + w_{21}\cdot\frac{w_{12}}{w_{12}+1} + w_{22}\cdot\frac{1}{w_{12}+1} =$$
$$= \frac{w_{12}}{w_{12}+1} + \frac{w_{12}}{w_{12}+1} + \frac{1}{w_{12}+1} + \frac{1}{w_{12}+1} = 2.$$

Consequently, the 2 × 2 matrix (44) is always consistent, therefore $\alpha(\tilde{s}) = \frac{w_{12}}{w_{12}+1}$, resulting in the problem (23) with function (22) takes the following form:

$$z_1^* \in \arg\min_{z\in U=\{z_j\}_{j=1}^{M}} \left\{\frac{w_{12}}{w_{12}+1}\cdot\tilde{s}_{IASCM}(z) + \frac{1}{w_{12}+1}\cdot\tilde{\theta}_{IASCM}(z)\right\} \quad (47)$$

Since the constant does not affect the minimum point in any way, the problem (47) is simplified to such a finite form:

$$z_1^* \in \arg\min_{z\in U=\{z_j\}_{j=1}^{M}} \left\{w_{12}\cdot\tilde{s}_{IASCM}(z) + \tilde{\theta}_{IASCM}(z)\right\} \quad (48)$$

## 3. Results

Approbation of the proposed model was carried out at one of the largest industrial enterprises of Ukraine - LTD Temp. Thus, at an initial stage, in order to determine the existing state of information and analytical support for cost management, it is necessary to analyze and evaluate the flows of external and internal information, which significantly affects the cost management system of LTD Temp. By specifying and evaluating the flows of external information by sources of its formation, it should be emphasized that the market conditions are characterized by a decline, since sophisticated technological equipment, produced by order of the Russian buyers, is practically not in demand from other potential customers. Therefore, the share of such products has significantly decreased, and the prospects for further cooperation are rather doubtful, although the implementation of these products has formed a significant share of the company's revenue. However, the management of the enterprise is actively pursuing the search for new markets and customers, therefore, at the moment, the prospects for active cooperation with Asian countries are being formed. And this requires a quick response from the management of the enterprise that comprises assessing the feasibility of cooperation with potential customers. This situation requires management to apply new active approaches, in order to determine the cost of production, prices, and the definition of financial results.

The relationship with consumers of the LTD Temp is formed on a long-term basis, and consumers' expectations regarding quality at a certain level of costs are justified in most cases.

The enterprise's suppliers are mainly domestic manufacturers who sell metal and electro-mechanical equipment with components. Therefore, from the position of minimizing costs, there is an alternative for choosing suppliers.

The expense mechanism of the investigated enterprise and the main competitors does not differ much. The most global impact on the specific functioning of the costing mechanism is the availability of orders and the level of labor congestion. However, the level of technology used in production processes does not always allow optimizing costs and needs to be improved.

Regarding the influence of institutional agents, it is primarily manifested due to insufficiently effective cooperation with fiscal authorities (especially when crossing the customs border and processing export operations).

Internal information on the status and existing approaches to cost management indicates a lack of attention of the company's management with regard to the formation of its development strategy, and analysis of the implementation of the cost management strategy. Although, a high level of staff creativity is noted, changes in the accounting policies of the enterprise regarding expenses are virtually non-existent. Also, there is the automation of cost management processes at the middle level, and there is practically no possibility of detailed tracking of the cost formation processes dynamics in the context of individual expenditure items. The presence of opportunistic behavior is also a negative phenomenon, although it characterizes some specialists more than the management team.

Taking into account the state of the cost information, management of the investigated enterprise and the main trends in the enterprise development, the most likely options for applying the cost management methods are presented in Table 1.

For the company under study, it is unlikely to use such methods as VCC, ABC-costing, as they involve an extensive system of automated production management and orientation to external information on future costs, which is not very relevant for LTD Temp.

Methods in the so-called "pure" form can satisfy the requests of individual groups of users (for example, owners prefer the standard-cost method), but it is not possible to reconcile the interests generally. Therefore, there is a certain probability of applying the "mix" methods or individual tools given in Table 1.

*Table 1. Variant set of cost management methods of LTD Temp in the context of improving the quality and efficiency of making management decisions*

| Variant | Method | |
|---|---|---|
| 1 | Absorption Costing | |
| 2 | Direct Costing System | |
| 3 | Standard Costing System | |
| 4 | Cost – Volume-Profit | Direct Costing System |
| 5 | Absorption Costing | Cost – Volume-Profit |
| 6 | Standard Costing System | Target Costing |
| 7 | Killing Costing | |
| 8 | Target Costing | Cost – Volume-Profit |
| 9 | Kaizen Costing | Standard Costing System |

Summing up the results of the analysis performed on the enterprise under study, it is reasonable to note the need to improve methodological approaches to cost management, but it is necessary to choose the most optimal methods based on the existing trends and results. That is why, basing on the proposed methodology and using expert estimates, we will determine the best cost management methods for LTD Temp. Thus, to ensure the soundness of managerial decision-making in the field of cost management by management, owners and controlling bodies (institutional entities), it is necessary to determine the best cost management methods in accordance with existing needs, requirements and available alternatives.

Evaluating the feasibility of using one or another method is carried out with the involvement of experts. For expert evaluation we involve 30 experts with approximately the same experience. Therefore, their weights are equal.

After having expert matrices $\left\{ \mathrm{S}_i = \left[ s_{mn}^{(i)} \right]_{M_0 \times M_0} \right\}_{i=1}^{30}$ and $\left\{ \Theta_i = \left[ \theta_{mn}^{(i)} \right]_{M_0 \times M_0} \right\}_{i=1}^{30}$ formed for each enterprise, where $M_0=9$ for LTD Temp by formulas (34) and (36), we determine the averaged matrices of pairwise comparisons.

For LTD Temp we have the following results:

$$\mathrm{S} = \left[ s_{mn} \right]_{9\times 9} = \begin{bmatrix} 1 & 1/4 & 1/4 & 1/2 & 1/5 & 1/8 & 1/7 & 1/8 & 1/7 \\ 4 & 1 & 1 & 3 & 1/2 & 1/5 & 1/4 & 1/5 & 1/4 \\ 4 & 1 & 1 & 3 & 1/2 & 1/5 & 1/4 & 1/5 & 1/4 \\ 2 & 1/3 & 1/3 & 1 & 1/4 & 1/7 & 1/6 & 1/7 & 1/6 \\ 5 & 2 & 2 & 4 & 1 & 1/4 & 1/3 & 1/4 & 1/3 \\ 8 & 5 & 5 & 7 & 4 & 1 & 2 & 1 & 2 \\ 7 & 4 & 4 & 6 & 3 & 1/2 & 1 & 1/2 & 1 \\ 8 & 5 & 5 & 7 & 4 & 1 & 2 & 1 & 2 \\ 7 & 4 & 4 & 6 & 3 & 1/2 & 1 & 1/2 & 1 \end{bmatrix}$$

and

$$\Theta = \left[ \theta_{mn} \right]_{9\times 9} = \begin{bmatrix} 1 & 1/6 & 2 & 4 & 1/4 & 1/6 & 3 & 1 & 1/3 \\ 6 & 1 & 7 & 9 & 3 & 1 & 8 & 6 & 4 \\ 1/2 & 1/7 & 1 & 3 & 1/5 & 1/7 & 2 & 1/2 & 1/4 \\ 1/4 & 1/9 & 1/3 & 1 & 1/7 & 1/9 & 1/2 & 1/4 & 1/6 \\ 4 & 1/3 & 5 & 7 & 1 & 1/3 & 6 & 4 & 2 \\ 6 & 1 & 7 & 9 & 3 & 1 & 8 & 6 & 4 \\ 1/3 & 1/8 & 1/2 & 2 & 1/6 & 1/8 & 1 & 1/3 & 1/5 \\ 1 & 1/6 & 2 & 4 & 1/4 & 1/6 & 3 & 1 & 1/3 \\ 3 & 1/4 & 4 & 6 & 1/2 & 1/4 & 5 & 3 & 1 \end{bmatrix}.$$

Matrices are consistent, because for LTD Temp:

$$I_{cons}(\mathrm{S}) = \frac{9.26-9}{9-1} = 0.0325,$$

$$I_{cons}(\Theta) = \frac{9.42-9}{9-1} = 0.0525,$$

$$r_{cons}(\mathrm{S}) = \frac{0.0325}{1.45} = 0.0224,$$

$$r_{cons}(\Theta) = \frac{0.0525}{1.45} = 0.0362.$$

The inequalities (42) and (43) regarding the obtained averaged matrices of pairwise comparisons are also performed. Therefore, we evaluate functions 1 and 2 by relations (40) and (41), and then we perform the rationing (10) – (13). So, for LTD Temp we have:

$$\left\{s_{IASCM}\left(z_{j_m}\right)\right\}_{m=1}^{9}=\left\{0.0181,0.0489,0.0489,0.0247,0.0731,0.2374,0.1557,0.2374,0.1557\right\},$$

$$\left\{\theta_{IASCM}\left(z_{j_m}\right)\right\}_{m=1}^{9}=\left\{0.0521,0.2815,0.0350,0.0175,0.1498,0.2815,0.02430,0521,0.1062\right\},$$

$$\left\{\tilde{s}_{IASCM}\left(z_{j_m}\right)\right\}_{m=1}^{9}=\left\{0.0645,0.1738,0.1738,0.0876,0.2596,0.8434,0.5533,0.8434,0.5533\right\},$$

$$\left\{\tilde{\theta}_{IASCM}\left(z_{j_m}\right)\right\}_{m=1}^{9}=\left\{0.1851,1.000,0.1242,0.0623,0.5323,1.000,0.0863,0.1851,0.3773\right\}.$$

Just as for the previous company, the matrix $\left\{\mathrm{W}_i=\left[s_{mn}^{(i)}\right]_{2\times 2}\right\}_{i=1}^{30}$ for LTD Temp were evaluated separately.

However, the matrix equals to (44) $w_{12}$=1 again, and task (48) has such a solution:

$$z^{*}\in\arg\min_{z\in U=\left\{z_j\right\}_{j=1}^{9}}\left\{\tilde{s}_{IASCM}\left(z\right)+\tilde{\theta}_{IASCM}\left(z\right)\right\}=\arg\min_{z\in U=\left\{z_j\right\}_{j=1}^{9}}\left\{0.2496,1.1738,0.2980,0.1499,0.7919,1.8434,0.6396,1.0285,0.9306\right\}=\left\{z_4\right\}$$

which corresponds to the fact that the mix of SVR-analysis and direct-costing (fourth line in Table 1) is the best IASCM for LTD Temp.

## 4. Conclusions

The developed and tested scientific methodical approaches developed to improve the information analytical provision of cost management allow harmonizing the interests of key actors of managerial influence by improving the quality of information and analytical support for cost management, and increasing the efficiency of making managerial decisions.

As a result of the model application, an optimal configuration of information and analytical support for cost management is formed, which enables to minimize costs and increase the efficiency and quality of managerial decisions. The practical implementation of the developed scientific methodological approaches was carried out at LTD Temp, taking into account the specifics of their activities and the state of the cost management system. It is determined that the optimal information-analytical support for cost management for LTD Temp is a combination of SVR-analysis and direct-costing. This testifies to the necessity and possibility of introducing alternative methods of cost management at modern industrial enterprises, and the expediency of improving information and analytical support for cost management, since it satisfies the needs for decision-making as the main subjects of cost management. Also, it is possible to ensure the harmonization of the interests among the main subjects of managerial influence by improving the information and analytical provision of cost management, which is confirmed by the actual improvement regarding the provision of information and analytical needs in the area of cost management within the main users' groups of the enterprises under study.

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