Modeling the objective function of a multistage organizational system

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Abstract
The paper considers the process of modeling objective function of a multistage organizational system, as well as approaches in defining the normative dimensions of organizational systems and finding the maximum of the objective function. An analyzed method of allocation allows you to distribute functional responsibilities for personnel performance and allocation of resources. The used algorithm is the maximization of the entropy function with constraints on the solution of the problem of balancing the variables of the organizational system limitations.
Keywords: ORGANIZATIONAL SYSTEM, THE OBJECTIVE FUNCTION, THE MAXIMUM OF THE OBJECTIVE FUNCTION

The specified parameters of the organizational system (OS) can be defined in several ways, all of which are based on the following principles:

1. So objective planning provides the maximization of the objective function, which describes the functioning of the OS under appropriate restrictions. If the models of this functioning are indeterminate in full amount, it is necessary to determine the maximum intensity of the functioning in the elements of the OS. With all this, the intensity of the functioning in the elements of the OS must be evenly distributed.

2. Another approach to defining normative dimensions of the OS is based on setting maximum value of dimensions in every element of this system; and achievements in these standards are expected from all the employees.

3. Defining the normative value of dimensions of the OS is also possible on the principle that if an employee has lowered the indexes of his working, he must raise his performance.

4. Sometimes the average value of operating dimensions must be chosen for employees.

Very often, it can be difficult to set the objective function, because different operating dimensions of the OS can be defined as main parameters of the objective function of the OS. Very often the objective function is represented as a deviation from the normative value of dimensions of the OS. Deviations from the normative value of dimensions of the OS are appropriate to be described in the form of a quadratic function, which is in its turn represented in the form of nonlinear problem.

At the same time, finding the maximum of the objective function cannot surely go to the proper effect, because the formulation of the problem for complex multistage systems is quite difficult.

Such problems, as a rule, describe the distribution of functional responsibilities between the personnel of the OS, the allocation of resources, raw materials, etc., which must be equable. Such problems are solved with the help of the method of allocation.

As an example, we consider the optimization distribution of functional responsibilities between the personnel of the OS. It is necessary to distribute functional responsibilities for performances P_a and $P_в$ between the multiplicity of employees M. Every employee j has its own performance P_a and $P_в$.

It is necessary to plan the performance according to personnel's functional responsibilities in such a way, so that the quantity of performance $P_в$-y_i would be equal to R, and the quantity of performance P_a-x_i would be maximum. Such a problem is solved with the help of the methods of linear programming.

$$\sum_{i=1}^{N} x_i + y_i = \sum_{i=1}^{N} s_i, \quad x_i, \quad y_i \geq 0, \quad j = 1,..., \quad M \quad (1)$$

$$\sum_{i=1} b_i \ y_i = R \quad (2)$$

$$\sum_{i=1} a_i \ x_i \to \max \quad (3)$$

In the performance of this problem, we obtain the following result. All the personnel according to their performances P_a and $P_в$ can be divided into three subsets: M_A(those who perform P_a), M_B (those who perform $P_в$) and M_0 (those who perform P_a and $P_в$ at the same time). In the performance of this problem, two inequalities are performed:

$$b_j / a_j \geq b_{j0} / a_{j0}, \quad j \in M_{\hat{A}}, \quad (4)$$

$$b_j / a_j \leq b_{j0} / a_{j0}, \quad j \in M_A, \quad (5)$$

The employees, performing P_a and $P_в$, are at the same time the employees of their structural subdivisions of the OS and they have the same problem, so that a complex approach is necessary to consider this problem P_a and $P_в$ in a more effective way.

This is a consequence of the fact that the overall information of the functioning of the OS cannot be obtained during the analysis. Consequently, having enough accurate description of the functioning of the OS, employees obtain enough accurate functional responsibilities for performances [1,2,4].

If we solve this problem with the help of the method of allocation, it is not necessary to find the maximum of the performance P_a. In this case, attention is focused chiefly on the distribution of functional responsibilities between the personnel of the OS for the performance $P_в$ and the resources $s = \sum_{j=1}^{M} s_j$ are distributed between these employees (j- every employee according to their functional responsibilities has their own volume of work s_j* R / s). Remaining resources of the personnel of the OS are distributed for the performance P_a. Such an approach is possible, when a_j and b_j are identical, i.e. they are not changed during the distribution of functional responsibilities between the personnel.

The method of allocation equally distributes functional responsibilities between the personnel.

If there are some limitations in the process of distribution of functional responsibilities between the personnel, it is necessary to use a balancing method, which integrates the elementary method of allocation and allows solving such problems [5,7] more effective.

As an example, we consider the distribution of functional responsibilities (the total number M) of the OS. Then we have such an expression:

$$x_j \geq 0, \quad j = 1, \quad M, \quad \sum_{j=1}^{M} x_j = \sigma. \quad (6)$$

where: x_j- employee's j functional responsibilities.

When the expression 6 does not carry out, it is necessary to distribute functional responsibilities between the personnel proportionally with the ideal distribution $\{x^0_j\}$. Then the expression 6 will have such a form:

$$x_j = c \ x_j^0, \quad c = \sigma / \sum x_j^0. \quad (7)$$

When the personnel of the OS is divided into σ multiplicity of disjoint groups with equal functional responsibilities and which have concrete limitations for every multiplicity, such an expression can be written:

$$\sum_{j \in M} x_j = \sigma_k, \quad k = \overline{1,e}, \quad (8)$$

We will try to satisfy the limitations successively, every time normalizing that part of vector $\{x_j\}$, which is among a recurrent limitation. In this way, having taken an initial value of the vectors $x_j = x^0_j$, and successively sorting out all the limitations for every of them, we consider, that

$$\tilde{n}_k = \sigma_k / \sum_{j \in M_k} x_j. \quad (9)$$

then we get

$$x_i = c_k \ x_i, \quad j \in M_k \quad (10)$$

For getting the expression 10, we consider that the initial values of elements of multiplicity (an entropy or equilibrium distribution) are equal to $x_j = x^0_j$, where x^0_j is an initial value of x_j.

Such a cyclical method is called a balancing method. Thanks to this method, the maximization of the expression 8 takes place according to this expression (weighted entropy):

$$\sum_{j=1}^{M} x_j * In\left(\frac{x_j^0}{x_j}\right) \to \max \quad (11)$$

The equilibrium distribution has the following characteristics:

1. An entropic allocation, defining permanently, depends on x^0_j and the right parts of limitations 8, it is also an interior point of a polyhedron of feasible solutions [6,8].

2. The multiplication of the right parts of limitations 8 and the vector $\{x^0_j\}$ by the scalar leads to the multiplication the allocation by the same scalar.

3. Fixing the variable x_{j1} at the level of x^*_{j1} does not change the proportions of allocation, calculated for the rest $j\epsilon M$.

As a criteria of planning at the equilibrium distribution of intensity must be used entropic models, appreciating the amount of total intensity by the magnitude

$$\Phi = \Phi_1 + \sum_{i=1}^{n} \sum_{j=1}^{m} \Phi_{ij}^H(t) In\left(\Delta t / \Phi_{ij}^H(t)\right) \quad (12)$$

Where $\{\Phi^H_{ij}(t)\}$ is the entropic distributive function of intensity of functional responsibilities between the personnel of the OS, and Φ itself is an entropic function [4,7].

$$\Phi = \sum_{i=1}^{n} \sum_{j=1}^{m} \Phi_{ij}^H(t) In\left(e\Delta t / \Phi_{ij}^H(t)\right), \quad (13)$$

Considering the fact that the gradient Φ is equal to 0 at the point $\Phi_{jj}(t)=\Delta t,\ j=1,m;\ i=1,n$, the equable distribution of levels of intensity $\Phi^0_i(t)$ takes place at the maximization (13).

The problem of maximization of the entropic function (13) with limitations (8):

$$\sum_{j=1}^{m} \Phi_{ij}^H(t) = \Phi_i^0(t), \quad i=1, \quad n,$$

$$\sum_{i=1}^{n} x_{ij}^H(t) = x_j^d, \quad j \in Z^d,$$

which can be represented for basic variables as:

$$\sum_{i=1}^{n} \hat{O}_{ij}^H(t) = \frac{x_j^d - \sum_{i=1}^{n} x_{ij}(t-\Delta t)}{s_j(t-\Delta t)}, \quad j \in V^d, \quad (14)$$

It is possible to use efficient algorithms for solving this problem with the help of the balancing method of variables with limitations.

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