

# Management by the efficiency of the local government

T N Nikulina<sup>1</sup>, U S Ivanova<sup>1</sup>, A A Stupina<sup>1,2,3</sup>, M V Karaseva<sup>1, 3</sup>

<sup>1</sup> Siberian Federal University, 79, Svobodny Ave., Krasnoyarsk, 660041, Russia

<sup>2</sup> Krasnoyarsk State Agrarian University, 90, Mira, Krasnoyarsk, 660049, Russia

<sup>3</sup> Reshetnev Siberian State University of Science and Technology, 31, Krasnoyarskii Rabochii, 660037, Russia

E-mail: [nikul@list.ru](mailto:nikul@list.ru)

**Abstract.** The paper proposes a comprehensive approach to the creation of a management system of modern municipality. All stages of such a system are considered.

The development of the economy is directly related to the consumer activity, and as a result, the most competitive organizations provide qualitative goods or services. The certain rules and techniques have been developed as a part of the quality management system (QMS) to maintain quality. The QMS has various goals and objectives. However, they usually intended to preventing mistakes that can negatively affect the quality of any product or service.

Any activity is characterized by the concept of efficiency. Every system has an unlimited number of properties. However, when exposed to each separate part of the system to operate with maximum efficiency, the system as a whole does not start functioning at the maximum level. The efficiency of the system depends not only on the work of each of its elements, but on their interaction. As a result, in the study of complex systems, special attention is paid to performance indicators that can be used for a comparative estimation of the design and development versions. A term “performance criterion” was introduced to determine the effectiveness, i.e. a condition on the basis of which an efficiency indicator is found [13, 14]. They are criteria classify as non-vector (the result of functioning is a set of indicators) and scalar (the result of functioning is a set of heterogeneous requirements).

The activities of the municipality can be described using the terminology of the efficiency theory. In order to improve the quality of services provided by municipalities, the QMS is being introduced everywhere. The quality and efficiency are interrelated and should be considered in cooperation. As a result, the QMS requires the integration of a performance management system (PMS).

Currently, there exist various methods to estimate the efficiency of the system that can be classified according to several criteria:

- depending on the goals;
- depending on the methodology;
- depending on the indicators.

In the late 1960s, Discriminant analysis (MDA) began to be applied. It forms a general indicator of the organization's activity. The main advantage of the approach is the consideration of a number of interrelated indicators typical for identical companies. Over the

next decades, researchers developed MDA, and probabilistic models (Logit and Probit) appeared.

Often, methods evaluate the efficiency of converting one turn (spent work) into one output (useful work). If we consider the efficiency estimation of the municipality, then the situation is changing sharply. It is necessary to analyze a lot of inputs (costs of equipment, capital used, number of employees, etc.) and a lot of outputs (services provided by categories, income received in the treasury, other types of income, etc.). The most important is that one cannot consider the efficiency of the municipality without its connection to the surrounding economic, legal, and political environment, i.e. environment of its functioning. That is the most important.

For the comprehensive and detailed consideration of the performance management problem, the detailed analysis of the following elements (components) is necessary:

- methodological support;
- mathematical software;
- algorithmic software;
- information support;
- software;
- hardware;
- organizational support;
- staffing.

The core of the system is software. Currently, there are various mathematical methods for estimating the efficiency of the system. One of the known is the "data envelopment analysis" (DEA) [1,2]. DEA is based on the application of linear programming. It was developed in 1978 in the USA, and it is applied almost everywhere [8]. To perform strategic analysis, PEST-analysis and the SWOT-method are applied [6]. PEST-analysis works with factors of the "distant" environment of the enterprise. The SWOT-method identifies the strengths and weaknesses of the organization, its capabilities and potential threats.

The "Data Envelopment Analysis" (DEA) method is widely used in Europe and the USA. It is used in the field of estimating the efficiency of functioning in the fields of economics, healthcare, administrative management, education, etc. [4-7]. In our country, this method has not been applied and it is almost unknown. However, the potential necessity and the effect of its application can be significant, due to the following reasons.

First, the international market entry of financial and industrial companies requires them to work with the same efficiency as other leading western organizations, or, using the language of this method; they are to be on the threshold of the efficiency.

Secondly, the current financial situation leads to the need for significant savings, and this, as an inevitable consequence, is for companies to work with the same (or greater) return (output), but at the lower cost (input).

The main advantages of applying DEA are as follows:

- absence of the necessity for a user to set the weights of the input and output parameters;
- absence of requirements for formulating and testing hypotheses about functional relationships between input and output parameters;
- ability to operate with a large number of input and output parameters;
- one can estimate the efficiency of the object by solving the problem of mathematical programming.

DEA can be attributed to the group of boundary methods based on constructing the boundaries of efficiency in a multidimensional space applying input and output variables,

where the level of efficiency will depend on the distance between the object and the boundary of efficiency.

Accordingly, inefficiency is the degree of remoteness of an object from the boundary of efficiency. Points that do not lie on the boundary of efficiency are correlated with objects that function inefficiently. The efficiency frontier is an estimation of the production function for the case when the output is a vector (based on real data). The DEA method has some advantages [9]:

- it does not apply a priori designations of weighting indicators (for input and output variables, it is possible to calculate a single aggregate indicator for each of the objects applying vector input and output);
- it is possible to take into account external variables, environmental conditions in the part of the system under consideration, in addition, managers' preferences regarding the priority of certain input or output variables;
- it forms a Pareto-optimal set of points that correspond to effective objects; it does not impose restrictions on the functional form of the relationship between inputs and outputs.

Despite the undoubted advantages of the DEA method, there exists a drawback. It is possible to obtain an indicator of only the relative efficiency of the subjects. To mitigate such a drawback, one should apply the knowledge of experts and use the artificial boundary of efficiency as a reference for the purpose of estimating real objects [10, 11]. It is possible to reach a value of the efficiency indicators are exceeding unities using artificial efficiency boundaries due to the object being estimated being in the multidimensional input/output space “outside” of the convex hull covered points that correspond to the reference objects.

Briefly, the main ideas of the algorithms are as follows. Groups of  $G$  experts  $g_k$  are generalized where  $k = 1, \dots, P$ . Each expert generalizes a reference boundary of efficiency  $F_k$ . In this case, the matrix of input  $X_k$  is for the dimension  $n_k$ , and the matrix of output  $Y_k$  is for the dimension  $s \times n_k$ . Further, such reference objects are grouped into a single unit (by combining the matrices  $X_k$  and  $Y_k$  into the matrices  $X$  and  $Y$  so that a number of columns of the new matrices is  $n = \sum_{k=1}^G n_k$ ). The following approach is applied in order to form a generalized boundary of efficiency using individual expert boundaries of efficiency. One should divide the resulting community of reference objects that experts generalize into “efficiency layers”, choosing one of the total mass as a generalized boundary of efficiency.

Methodological support also includes methods describing the operation of objects with a complex hierarchical structure. Municipality is a complex system with intensive external relations that is in constant close interaction with different territories, public institutions that form the environment [12]. It is possible to form a holistic technology using the existing mathematical and algorithmic tools with the help of diverse techniques. It in turn will save a user (a leader, analyst, etc.) from manual execution of routine operations. It should be noted that the software is a micro level, as well as the methodical support is a macro level. It is quite possible to obtain general performance indicators of a complex system (municipality) taking into account the efficiency of subsystems (departments, administrations, territorial units) as a result of applying various methods. It in turn will reduce the amount of information provided to an official for decision-making.

The main technical tool is a decision support system (DSS) developed using the achievements of the efficiency theory and can be applied as an analytical and a consulting tool for conducting comprehensive studies of the efficiency of complex systems [3].

An important problem is the choice of software for the implementation of the DSS. The tools used must ensure the reprogramming of the product in a variety of operating environments: a software product (of course, after recompilation of the source texts) should operate in a variety of operating system environments.

Information support is the initial data that will be applied in the indicators and criteria calculation for the efficiency evaluation. One of the main roles can be attributed to the automated information system (AIS) under the code name "Municipality". The exact data of some periods should be accumulated in such a system. It will provide an opportunity to estimate the achieved level of all subsystems of the municipality to formulate a forecast of the efficiency level for the future.

Organizational support is the development of performance indicators and criteria, decision making in the field of management to carry out measures to estimate efficiency at all structural levels of the municipality. These measures should be regular in nature, they should provide for an appropriate reporting system and response measures provided that deviations of performance indicators from a given level are detected.

The activities on estimating the efficiency of the municipality will solve the following problems:

1. Estimating the efficiency of the municipality within the city, region and the country as a whole.
2. Estimating the efficiency and activity level of departments, administrations and territorial units of the municipality and comparisons by other territorial units of local self-government in Russia.
3. Estimating the rationality of the organizational structure of the municipality.
4. Estimating the degree of achievement of the main goals of municipality.
5. Estimating the combination of needful, productive and cost efficiency (this may be relevant in conditions of a budget deficit at all levels).
6. Estimating the overall social efficiency (performance of specific units and officials).

The proposed system is based on mathematical methods that affect the growth of the staffing value. The proposed organizational and technical solutions contribute to improving the management efficiency not only of a single municipality, but also of the entire municipal management system as a whole.

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