Efficiency and Optimization of Enterprises Based on an Assessment of Its Leading Structural Elements

Natalya Efanova*
Federal State Budgetary Educational Institution of Higher Education
"Kuban State Agrarian University named after I. T. Trubilin"
Kalinina str. 13, 350044 Krasnodar
Russian Federation
e-mail: efanova.nv@gmail.com

Elena Ivanova
Federal State Budgetary Educational Institution of Higher Education
"Kuban State Agrarian University named after I. T. Trubilin"
Kalinina str. 13, 350044 Krasnodar
Russian Federation
e-mail: elena_is_kubagro@mail.ru

Daniil Emelianov
Federal State Budgetary Educational Institution of Higher Education
"Kuban State Agrarian University named after I. T. Trubilin"
Kalinina str. 13, 350044 Krasnodar
Russian Federation
e-mail: zingerion@gmail.com

Abstract The purpose of this paper is to develop models to improve the efficiency of project teams based on its leading structural elements. There is a quantitative the efficiency indicator corresponding to the number of works performed. At the same time, the efficiency indicator is the sum of the effectiveness of individual elements. This approach allows to identify the least effective elements of the enterprise and choose the most financially advantageous way to optimize the organization or its department. One of the main tools for achieving the goals presented in this paper is the formalization of the assessment of the quality of workers and elements of the enterprise. This allows to match the effectiveness of the element of the enterprise numerical value, which makes it possible to measure the effectiveness of the enterprise.

Our results allowed us to develop a model that allows to optimize the composition of groups of employees to perform certain managerial tasks, as well as ensuring a more rational use of enterprise resources, based on the effectiveness of its elements. This model meets all the goals mentioned above. This research enables us to assess the functioning of the enterprise from the point of view of its components which allows a qualitative analysis of its economic efficiency, and, therefore, gives managers of organizations the opportunity to increase the work potential of organizations in general and its specific departments in particular.

Keywords: efficiency, optimization, enterprise, leadership, structural element

1 Introduction

The main prerequisites for the development of a method for optimizing the composition of groups is the structuring of requirements for elements of the enterprise with the subsequent assessment of these requirements. It is no secret to anyone that inaccurate or fuzzy requirements are often imposed on employees as elements of an organization. For example, getting a job in a large company, you can find in the employment contract such requirements: "follow orders of the supervisor." Assessing an employee based only on this requirement is quite difficult.

Moreover, this fact brings much more troubles to the management of the company than to the employee himself. Indeed, failure to comply with requirements can have unpredictable consequences for both management staff and the entire organization. In this regard, there is a need to structure the approach to evaluate the work of personnel.

The main problem formulated in this paper is the optimization of enterprises and team groups by assessing the quality of their constituent elements. The proposed problem is at the intersection of such disciplines as management, fuzzy logic, systems analysis, and managerial psychology. Solving it will allow you to create a

model that can be further applied to solve the issue of optimization and increase the efficiency of various structures.

2. Literature review

A well-known approach to solving such problems is to use the Cobb-Douglas function, in which the measure of effectiveness of the requirements for the employee, as well as the measure or percentage of the employee fulfilling these requirements, acts as a technological coefficient. This function was used because it allows us to describe and predict the state of microeconomic entities (Popov and Kac 2003).

In articles of various authors (see e.g. Boyarchenkova 2012; Husain and Islam 2016; Vetlugina and Tyunin 2016; or Pshenichnikova 2018) on the use of the Cobb-Douglas function in applied problems, there are no references to methods for obtaining the technological coefficient. Most of the works (see Gurina 2005, Popov and Kac 2003, ZHil'nikov 2013) on the modification of this function describe its information parameter. Some works investigate the linearization of its parameters (Chechulin 2013). It is worth noting that in some works on the calculation of macroeconomic indicators, the technological coefficient is defined as the coefficient of proportionality, which changes every 30-40 years (Dubnickij and Savchenko 2009, Pshenichnikova and Romanyuk 2017). This does not give a clear answer about for what purposes this coefficient can be used in microeconomic problems. Works in which the Cobb-Douglas function is used to study enterprises or educational institutions also do not give a clear idea of the technological coefficient estimation (Vaseckaya and Gluhov 2019).

Based on the foregoing, the relevance of the study lies in the fact that the developed model will allow heads of organizations to effectively select and group the composition of the elements of the company, change the structure of project teams and, based on this, determine the strategy of economic development of the company. The main aim of this paper is to develop a model that would allow us to analyse the work of enterprises and, based on this analysis, to optimize and improve efficiency.

3. Materials and methods

For further work with the evidence base, it is necessary to demonstrate, using specific examples, the use of terms such as "efficiency", "Element Relative Performance" and "Minimum efficiency".

As an example, consider a catering company (restaurant), consisting of two logical units: a kitchen and a lounge. The effectiveness of the kitchen can be estimated as the number of dishes prepared per unit time. The effectiveness of the hall will be considered as the number of dishes given to the hall. Then we can assume that the effectiveness of the restaurant will be equal to the effectiveness of the hall, since in the end it is determined by how many ready-made dishes the restaurant sells.

To further describe the model, it is necessary to determine the requirements for evaluating the effectiveness of an employee as an element of the organization, and to set a table of the relative effectiveness of the elements. Evaluation requirements can be made up in the form of a fuzzy function or in the form of a set of criteria with weights corresponding to each criterion, where for the weight of each criterion its own criteria or its own function can be set. Moreover, each corresponding weight can be set and calculated using certain methods of fuzzy mathematics. Zero in this model can describe the complete non-compliance of the employee with the requirements.

Let us consider an example of requirements for a restaurant administrator from the above organization using a set of criteria with weights. The requirements for this element will be:

1. Meeting guests.
2. Maintaining comfort and pleasant surroundings for guests in the hall.
3. Human resource management (training for beginners, scheduling, motivation of employees, control of the work process).
4. Work with documentation, reports, conducting inventories.
5. Resolution of conflict situations.
6. Execution of official duties of the head/

Based on the above requirements, we compile a table with the weights of each criterion (Table 1).

Table 1. Requirements for the element "Administrator" in the form of a list of criteria with weights

Criteria (requirements for element)	Criterion weight	Description
Meeting guests	0,15	For each guest who was not conducted to the table and was not greeted, the efficiency rating is reduced by 20% (from 0.15 to 0.12)
Maintaining comfort and pleasant surroundings	0,15	For each act of inaction in the presence of "noisy" guests, the effectiveness rating is reduced by 15% For every time when the music in the restaurant does not correspond to the general concept of the institution or event, the weight is reduced by 15% (from 0.15 to 0.1275)
Human resource management	0,25	For every time not served table weight is reduced by 20% For each case of waiter behaviour that does not comply with job descriptions, the weight is reduced by 20% (from 0.25 to 0.2)
Resolution of conflict situations	0,25	For each conflict situation, as a result of which the guest was dissatisfied with the outcome of the conflict, the weight is reduced by 15% (from 0.25 to 0.2125)
Work with documentation	0,1	For each incorrectly pre-ordered weight is reduced by 10% (from 0.1 to 0.09) For each error in the report or inventory sheet, the weight is reduced by 10%
Execution of official duties of the head	0,1	For each failed order, the weight is reduced by 10% (from 0.1 to 0.09)

Source: Own results

Let us consider the following situation: suppose that during the analysis of the guests' visits and the restaurant's work, it was found out that during the month during the change of administrator Mrs. Zakhonina (the full name is fictitious, any coincidence is only by chance), one guest was not conducted to the free table on time. There was one situation when the guest was not satisfied with the result of resolving the conflict, in addition, 3 situations were revealed when the administrator was inactive in relation to guests who were noisy. Throughout the month, the documentation was completed correctly, without complaints, all official assignments were completed on time. The waiters were friendly and friendly, however, during the high load of the hall, one table was served 25 minutes more than it should be.

4. Results and discussion

In this section, we calculate the relative effectiveness of Mrs. Zakhonina. The criterion of "meeting guests" will have a final value of 0.12, "maintaining comfort" - 0.1275, "human resource management" - 0.2, "resolving conflict situations" –0.2125, "working with documentation" and "performance of official orders" for 0.1. Thus, the relative effectiveness of Mrs. Zakhonina will be estimated at 0.86.

Each functional element of the organization is associated with its own cash expense, which displays how much money in the selected currency per unit of time the company spends on the content of the element. In other words, when drawing up the model, it is necessary to determine how much money the company spends on the element per unit time. We denote these costs as wm (waste of money).

Denote the administrator Mrs. Zakhonina as a variable X. The company spends on salaries and various deductions for Mrs. Zakhonina 38000 rubles per month. Then wm (X) = 38000. We turn to the Cobb-Douglas function:

$$Y = A \times K^{\alpha} \times L^{\beta} \tag{1}$$

where:

Y - the volume of output;
L - labour costs;
K - the cost of capital;
A - the technological coefficient;
α - the coefficient of elasticity according to work;

β - capital elasticity coefficient.

Coefficient A is an intangible factor, which includes the features of technology and human knowledge. At the same time, the relative effectiveness calculated by us for the employee ef is a factor that includes the correspondence of the knowledge and skills of the employee to those that the manager sees. When replacing the coefficient A by *f* in the Cobb-Douglas function, a function is obtained that shows the dependence of the volume of the product on labour, capital and the correspondence of the functional elements of the enterprise to its requirements.

We also introduce one more coefficient: ς - the coefficient of elasticity with respect to the relative efficiency of the element ef. Moreover, α + β + ς = 1, which represents the share of labour, capital and relative efficiency in the total product, since ef directly affects the volume of production:

$$Y = ef^\varsigma \times K^\alpha \times L^\beta \tag{2}$$

Denote by *EM* the volume of production and services provided by the organization. Since the definition of EM is a more general concept than Y (only the volume of production), we establish the relationship both between the volume of goods produced and the number of services rendered:

$$EM = ef^\varsigma \times K^\alpha \times L^\beta \tag{3}$$

The above function also allows you to evaluate the adequacy of the requirements for the employee: the less the EM value changes with ef changing by 1%, the more ineffective the requirements for the employee are and vice versa.

It should also be noted that the resulting dependence does not contradict the laws of microeconomics, including the law of diminishing efficiency: "with an increase in the use of one resource, while others remain unchanged, the marginal product of the variable factor will decrease."

The consumption value introduced by us above for the content of the element wm allows us to determine the feasibility of purchasing (maintaining) the elements of the enterprise and to optimize its costs. For clarity, let's draw up a table where for each employee who is in the same position of the company, his experience in the company, the relative effectiveness of him as an element of the enterprise ef, and his salary wm will be set (see Table 2).

Table 2. Analysis of the elements of the company

Full name*	Length of work (month)	Element Relative Performance *ef*	Salary *wm*, rub
Kortikov E.A.	10	0,90	34000
Zhilina E.V.	2	0,73	25000
Nurmagomedov S.S.	5	0,94	32500
Fitlikof F.A.	15	0,93	41000
Zakhonina D.A.	11	0,86	38000
Sinitsyn M.A.	6	0,79	28000

Note: * All names are fictitious, any coincidence is accidental

Source: Own results

According to the data obtained, it is possible using various methods and approaches to analyse the relative effectiveness of employees and the corresponding income in order to optimize the company's expenses on wages. This allows you to solve various tasks for the selection of personnel, for example, justify the feasibility of hiring young professionals or specialists with work experience.

It is also useful to introduce the coefficient of scientific and technological progress into the above formula, since most modern companies are based on an intensive development path:

$$EF = ef^\varsigma \times K^\alpha \times L^\beta \times e^{pt} \tag{4}$$

From the above formula, it is necessary to express the dependence of EF on ef. This relationship will allow you to apply measures to increase the efficiency of EF.

Consider a specific practical example of its application: in the restaurant's kitchen, specialists of various profiles work: chef, sous-chef, cold appetizer, line cooks, cook-chopper, etc. The table of employees with the

corresponding ef indicators and monthly salaries is presented below (Table 3). The restaurant was tasked with increasing the number of cooked dishes per month by 10%. In this case, the following dependence of EF on ef was found: an increase in ef by 0.1 gives an increase in EF by 4.2 cooked dishes (a dish is considered cooked if it meets all the standards presented to it). After analysing the operation of the kitchen, the following measures that increase relative efficiency were proposed:

- premium bonus in the form of 10% of the monthly salary increases the kitchen ef by 0.58;
- group training worth 11% of all monthly salaries increases ef cuisine by 0.68;
- hiring a young employee with a salary of 22,000 rubles per month with ef = 0.65.

Table 3. Restaurant staff

Full name	Element Relative Performance ef	Salary per month, rub
Kadzhimov V.S.	0,86	30000
Vydrina E.S.	0,79	48000
Emelianenko G.P.	0,88	20000
Vasilenko A.A.	0,90	30000
Petrov K.G.	0,90	43000
Mukhina P.E.	0,88	25000
Fokin E.K.	0,87	43000
Total	6,08	239000

Source: Own results

After all calculations, the following results were obtained:

- premium bonus costs 23,900 rubles, which gives 386.6 rubles for 0.01 ef;
- group training costs 26,290 rubles, which gives 386.6 rubles for 0.01 ef;
- hiring a young specialist will lead to costs of 22,000 rubles which gives 338.5 rubles for 0.01 ef.

In addition, it was found that the relative effectiveness of young professionals increases over time. Thus, we can conclude that the most optimal way to increase efficiency in this case is to hire a young specialist.

5. Conclusion

Thence, the main result of our paper was the development of a function that reflects the dependence of the volume of production and services provided on the relative efficiency of the elements of the enterprise, as well as the cost of capital and labour.

The resulting function allows us to analyse the enterprise from the point of view of the relative effectiveness of its elements and, in addition, to optimize the work of departments of the organization and the entire enterprise.

There is no doubt that the results obtained in the work need applied checks and implementations in specific enterprises in order to establish more specific and clear dependencies. At the same time, already in the form described in the article, the conducted studies will allow the analysis of the enterprise and the initial optimization of the work of departments and organizations as a whole in order to increase the efficiency of their functioning.

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