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## Assessing the efficiency of management and land use in the agrarian sector of municipalities

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**Abstract.** Improving the methodology for assessing the efficiency of management and land use of the agricultural sector of municipalities as a determining factor in the development of rural areas plays an important role in solving the problem of effective functioning of the agricultural territorial complex. Scientifically based assessment allows to analyze the efficiency of management and land use of the agricultural sector by ensuring the comparability of the results. The fairness and scientific validity of the evaluation results are important. The authors substantiate the expediency of applying a new methodological approach to the assessment of the efficiency of management and the use of lands of municipalities in practical analytical activity. The authors of the article developed and tested the method of assessing the efficiency of management and land use of the agricultural sector of municipalities in the region. This technique is based on the calculation of the efficiency of management and land use. The calculations were performed using a specially developed package of applications and cluster analysis. The proposed methodology makes it possible to identify effectively developing municipal entities of the region and ensures the comparability of the calculated indicators. This expands the possibilities and makes it more statistically correct to use the coefficient for a fair assessment of the work of the agrarian sector of municipalities.

The proposed methodological approach can be recommended for practical use for evaluating the effectiveness and other types of economic activity of municipal formations of a region, socio-economic development, social development by type of activity (education, health, culture, housing and communal services).

Improving the methodology for assessing the efficiency of management and land use of the agricultural sector of municipal formations as a determining factor in the development of rural areas plays an important role in solving the problem of the effective functioning of the agricultural territorial complex. Information technologies in the agro-industrial complex make it possible, with the help of economic and mathematical methods, to evaluate the efficiency of management and land use in the agricultural sector of municipal formations. A scientifically based assessment allows for an analysis of the efficiency of management and land use of the agricultural sector by ensuring the comparability of results. Equity and scientific validity of the assessment results are important.



At the regional level, it is necessary to evaluate the efficiency of management and land use of the agrarian sector of municipal formations of the region. Such an analysis contributes to the optimal distribution of investment potential, the allocation of strategic economic management and strategic economic centers of the agricultural sector of the region.

When developing a methodological approach to assessing the efficiency of management and land use of the agricultural sector of municipal formations in the region, we were aware of the inconsistency and limited use of integral coefficients in analytical economic work. In our opinion, the use of the integrated rating method for assessing the integrated development of rural municipal formations in the region is limited. We attribute this limitation to the work itself. However, we recommend using our approach in the analytical work of regional economic services to assess the efficiency of management and land use of the agricultural sector of municipal formations of the region, given the fact that in our country the degree of scientific development of the problem of integrated rating assessment of rural areas is extremely limited. In the literature we have studied, there is still no methodology for analyzing the correctness of using the method of integrated rating for the purposes of long-term strategic state management of agriculture in the region.

The use of a rating system became possible only with the development of economic relations of the market type [2, p. 286]. The information capabilities of the current period have significantly expanded the terminological range and methodological tools of economics. In business practice, lists of several indicators are popular for subjects ranked by a single indicator. These indicators often include the characteristics of the scale of the subject – capital, capitalization, assets, turnover of economic activity, etc. Among experts and analysts are also popular estimates of profit, profitability, profitability (capital, assets, investments in the relevant activity, etc.).

At the first stage of using the rating system, a comprehensive assessment is carried out on the basis of relative deviations of the development indicators of a particular region from their best values in other regions. At the second stage of this work, the arithmetic average of the ratings of a particular region for each of the indicators is determined. According to the results of the calculation, the place of each region in the overall rating is determined. The best is the region for which the arithmetic mean of the sum of the ratings is the lowest.

However, we identified two obstacles to the implementation of the methodology under consideration. The first, in our opinion, is incompatibility of regions in terms of the level of agricultural development, since even neighboring areas differ significantly in favorable soil and climatic conditions, by specialization and by historical productivity of livestock. The second obstacle to the practical use of this technique is due to the discrepancy in time of the dynamics of destructive and restorative processes in the agricultural sector.

The advantage of our proposed approach is that we identify effectively and inefficiently operating municipal formations within the boundaries of the region, which ensures relative comparability of the calculated indicators [1, p. 45]. This expands the possibilities and makes it more statistically correct to use the coefficient found for long-term strategic planning of the integrated development of agriculture in municipal formations within the region's borders.

In the course of the study, we developed and tested a methodology for assessing the efficiency of management and land use of the agricultural sector of municipal formations in the region, based on the calculation of the coefficient of efficiency of management and land use (CEM& LU or KEKHiZ). The technique was tested on materials of the Oryol region.

During the approbation, the data of the territorial body of the Federal State Statistics Service in the Oryol region were used.

The criteria for the selection of indicators, on the basis of which KEKHiZ was calculated, were their “unidirectionality” and the obligatory presence in the state statistical reporting. The criterion of “unidirectionality” was chosen by analogy with the standard deviation in the correlation and regression analysis, in the case of which it is leveled, including the “zero value” of the sum of positive and negative deviations from the average. In our case, we each considered the KEKHiZ indicator as a private indicator of the economic potential, the increase of which leads to an increase in the weighted

average of the efficiency of management and land use in the agricultural sector of municipal formations in the region. The expediency of using the performance indicators of the agricultural sector of municipal formations of the region selected by us is also explained by the fact that the basis of the methodological approach was already to develop the idea of checking its correctness using cluster analysis, in which factors are considered as objects of multidimensional space, peculiar “stars,” thickening which (“nebula”) allows us to distinguish groups of similar objects (in our case, rural areas of the region).

The algorithm is the following:

1. We calculated the weighted average performance indicators of the agrarian sector of the regions of the region on the initial data tables:

$$\Pi_{\text{CP.B3B } ij} = \frac{\Pi_{ij}}{\sum_{i=1}^n \Pi_{ij}/m}, \quad (1)$$

where  $\Pi_{\text{CP.B3B } ij}$  – the weighted average performance of the agricultural sector of the municipal formation of the region;

$i$  – a specific performance indicator;

$n$  – a number of performance indicators;

$j$  – a municipal formation of the region;

$m$  – a number of municipal formations in the region (in our case  $m = 24$ ).

The weighted average performance indicators were determined for each municipal formation of the region by dividing its indicator by the average for the region. The average for the region was determined as follows: the amount for each column of the source data table was divided by 24 (the number of municipal formations of the Oryol region). This ensured the reduction of indicators for each municipal formation in a comparable form.

2. The coefficient of efficiency of management and land use of the agricultural sector was determined for each municipal formation of the region:

$$K_{\text{ЭХиЗ } ij} = \frac{\sum_{i,j=1}^{n,m} \Pi_{\text{CP.B3B } ij}}{n}, \quad (2)$$

where  $K_{\text{ЭХиЗ } ij}$  – coefficients of economic and land use efficiency of the agricultural sector of a specific municipal formation of the region.

To do this, we calculated the coefficients of economic and land use efficiency for each specific municipal formation of the region. Each indicator was averaged by dividing by the number of analysis indicators. This ensures the “universality” of the methodology, its independence from the number of indicators considered in determining the KEKHiZ. The coefficient of efficiency of management and land use of the agricultural sector of a specific municipal formation of the region was determined as the sum of indicators for each specific municipal formation of the region.

Currently, there is a sharp increase in the amount of information, explained by the expansion of the scope of application and improvement of technical parameters of computer equipment [3, p. 35]. Therefore, the universality of the methodology is explained by the fact that it is not limited either by the number of considered parameters, or by the number of considered objects (in our case, areas). This is a clear advantage.

The results of calculations of the coefficient of efficiency of management and land use of the agricultural sector for each specific municipal formation of the region according to the results of work in 2017 are summarized by us in Table 1.

**Table 1.** KEKHiZ values for municipal formations of the region.

<b>Municipal formation of the region</b>	<b>Conditional number</b>	<b>KEKHiZ, units</b>
Bolkhovskiy	1	0,869
Verkhovskiy	2	1,301
Glazunovskiy	3	0,859
Dmitrovskiy	4	0,921
Dolzhanskoy	5	1,019
Zalegoschenskiy	6	0,876
Znamenskiy	7	0,610
Kolpnyanskiy	8	0,958
Korsakovskiy	9	0,500
Krasnozorenskiy	10	0,798
Kromskoy	11	1,199
Livenskiy	12	1,666
M. Arkhangelskiy	13	0,849
Mtsenskiy	14	1,700
N. Derevenkovskiy	15	0,879
Novosilskiy	16	0,605
Orlovskiy	17	1,792
Pokrovskiy	18	1,320
Sverdlovskiy	19	1,112
Soskovskiy	20	0,628
Trosnyanskiy	21	0,907
Uritskiy	22	1,131
Hotynetskiy	23	0,803
Shablykinskiy	24	0,700

In table 2, areas of the region were grouped by us according to the coefficient of efficiency of management and land use of the agricultural sector.

Evaluation of the level of efficiency of management and land use was made on the basis of the KEKHiZ value: less than 0.85 – inefficient management and land use; 0.85-1.1 – satisfactory level of management and land use; more than 1.1 – efficient management and land use.

The reliability of the grouping of municipal formations of the region in terms of the efficiency of management and land use of the agricultural sector was verified by us using cluster analysis. As a matrix of source data, we used all the indicators presented in the table of source data without exception.

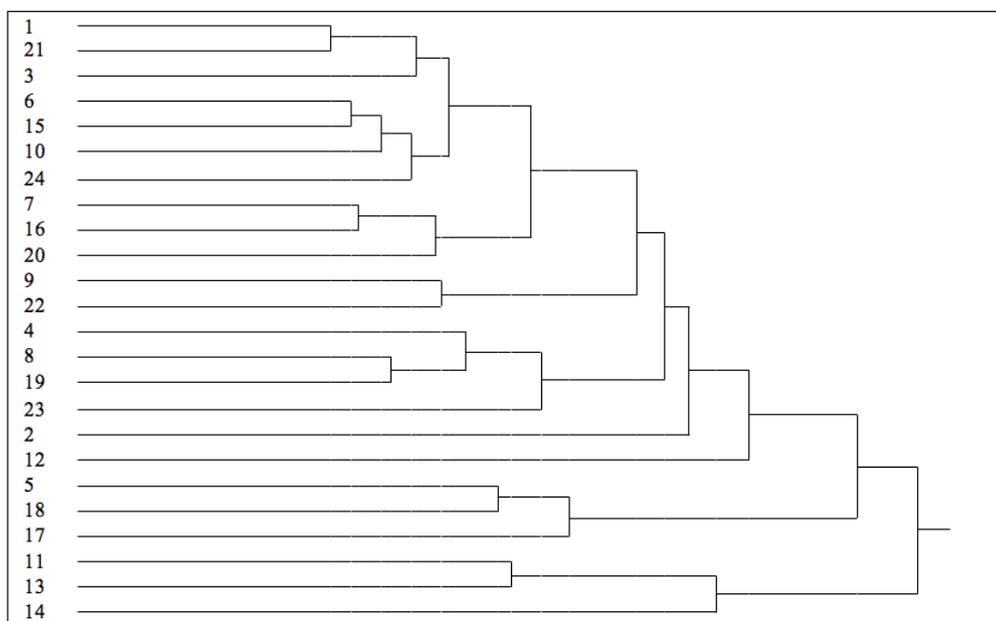
**Table 2.** Grouping of municipal formations of the Oryol region by the level of efficiency of management and land use of the agricultural sector.

<b>Municipal formations of the region</b>	<b>KEKHiZ, units</b>	<b>The level of efficiency of management and land use</b>
Orlovskiy	1,792	
Mtsenskiy	1,700	
Livenskiy	1,666	
Pokrovskiy	1,320	Efficient management and land use
Verkhovskiy	1,301	
Kromskoy	1,199	
Uritskiy	1,131	
Sverdlovskiy	1,112	
Dolzhanskoy	1,019	Satisfactory management and

Kolpnyansky	0,958	land tenure
Dmitrovsky	0,921	
Trosnyansky	0,907	
N. Derevenkovsky	0,879	
Zalegoschensky	0,876	
Bolkhovsky	0,869	
Glazunovsky	0,859	
M. Arkhangelsky	0,849	
Hotynetsky	0,803	
Krasnozorenskiy	0,798	
Shablykinsky	0,700	Ineffective management and
Soskovsky	0,628	land use
Znamensky	0,610	
Novosilsky	0,605	
Korsakovsky	0,500	

Based on the results carried out using the cluster analysis program, a graph of similarity of the levels of efficiency of management and land use of the agricultural sector of the region’s municipal formations was constructed. It is visually presented on Fig. 1.

The graph of similarity between the levels of efficiency of management and land use of the agricultural sector of the municipal formations of the region showed a good level of efficiency in the Orlovsky, Livensky, Mtsensky, Pokrovsky, Verkhovsky, Kromsky, Uritsky, and Sverdlovsky districts of the Oryol region. Ineffective management and land use are observed in M. Arkhangelsky, Hotynetsky, Krasnozorensky, Shablykinsky, Soskovsky, Znamensky, Novosilsky, and Korsakovsky districts. The graph fully confirms the results of the calculations presented in Table 2.



**Figure 1.** The similarity of levels of economic efficiency and land use of the agricultural sector of the region’s municipalities.

The consistency of the calculation results with the results of the rating of municipal formations of the region for the production of main agricultural products in farms of all categories conducted by the territorial body of the Federal State Statistics Service for the Oryol Region speaks about the correctness of the conducted grouping and evaluation [5].

I would especially like to note the advantage of the approach developed by us due to the use of a larger number of factor signs affecting the efficiency of management and land use.

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