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INTEGRATED ASSESSMENT METHODOLOGY FOR LAND CONSOLIDATION PROJECTS: CASE STUDY PECINCI, SERBIA

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RESUME

Changes in the structure and fragmentation of land plots, arising from the process of privatization and restitution, as well as from the realization of large-scale infrastructural projects in Southeast Europe and similar, actualize problems in terms of intensive agricultural production, and aesthetic and functional spacing design. The need for initiating new projects regarding land consolidation cycles is increasing with the aim to solve spatial, environmental, and strategic issues in agriculture, as well as to provide appropriate conditions for the application of modern land treating methods. However, land consolidation projects are very complex, long-lasting and financially very demanding. To minimize risk and exclude the possibility of inadequate selection methods, this paper describes the methodology for integrated assessment, which allows decision making on the basis of two or more methods. Per integrated assessment methodology, this study includes several multi-criteria analysis methods, which do not exclude the possibility of integrating other methods. The results obtained in this study are not only beneficial to the South-Eastern Europe region, but also to all countries where land redistribution is expanding.

Key words: *land consolidation, cadastral municipality, land redistribution, evaluation of projects*

INTRODUCTION

Modern aspects of land consolidation significantly exceed the framework of agricultural production acceleration. It has become an instrument for total land complexion, which should reach a compromise in meeting the different, often conflicting, demands such as environmental protection, an aesthetically appealing and functional design, and intensive agricultural production. To meet various requirements of land consolidation, projects involve hiring many experts in different fields, which significantly complicates the implementation of projects which are becoming a bigger financial burden.

The land consolidation represents a planned process through which land parcel distribution and ownership arrangement are carried out [1]. Moreover, land consolidation is defined as a process in which small land plots are integrated to form a centralized, integrated and continuous land in areas where agricultural land is not exploited effectively [2]. Therefore, increasing the quality of life in rural areas must include specific actions, such as improving agricultural production, employment, infrastructure, public goods, housing and natural resources [3,4]. According to research conducted in China through the implementation of land consolidation projects, four types of projects were developed and implemented [5]: 1) A project to increase arable land and utilize agricultural machinery, 2) An irrigation and drainage project [6], 3) Networking of agricultural roads and 4) A project of agro-protection forest belts.

Considering the situation in Europe, the major problems in terms of the implementation of land consolidation projects occur in the transition countries of South-eastern Europe. A series of undertaken reforms, which included the sale or lease of agricultural land owned by the state to individuals, businesses and others, deteriorated the situation regarding the effectiveness of land management even further. Land consolidation is usually a part of a wider program for the regional development of rural areas, which, besides improving agricultural production, includes employment, tax policy, infrastructure, public facilities, housing, protection of natural resources and several other sub-projects [7].

In some studies, it is stated that the multi-criteria analysis is a powerful tool for analysing complex problems of choice, such as land consolidation projects [8]. According to Triantaphyllou, numerous multi-criteria problems associated with land, require decision-making [9]. These problems are not solvable by using conventional mathematics. They require a procedure of logical research, leading to an acceptable compromise. Methods for ranking the land redistribution project aim to reduce the risks of incorrect selection of the project on which limited resources will be engaged [10]. In a broader context, these methods belong to the theory of decision-making [11].

The aim of this study is to define and characterize land redistribution projects. Further, the research goal is to provide a holistic overview and create the basis for an objective model definition, suggest the relevant criteria for ranking cadastral municipalities as well as multi-criteria analysis methods and their application in the ranking of the land redistribution projects.

THE STRUCTURE OF INTEGRATED ASSESSMENT METHODOLOGY FOR LAND CONSOLIDATION PROJECT RANKING

To perform the integrated ranking of land redistribution project, it is necessary to define the model with which cadastral municipalities could be evaluated. Having in mind that model generation integrates several different methods of multi-criteria analysis, suggested steps and activities described in the following paragraphs should be carried out.

Evaluation model for land redistribution projects

To formulate an evaluation model for land redistribution projects, it is necessary to define objective criteria and alternatives. The implementation of a multi-criteria analysis is often carried out in several stages: Identification of alternatives, defining the key criteria for alternative evaluation, conducting an analysis of interdependence criteria, assigning importance to each criterion, based on the research findings and professional judgment of individuals or teams of decision-makers, determining the value of each criterion for each alternative, selecting a criteria optimization procedure that corresponds to the type of problem to be solved, analysing results and accepting the final decision [12].

Defining the criteria

Some authors [13,14,15,16] have shown that a multidisciplinary approach to land consolidation projects provides useful support for the decision making process in land consolidation. A reliability decision taken depends on the defined relevant criteria which vary from country to country due to differences in natural and social conditions as well as different objectives of land policy [17].

There is a lack in holistic methodology that is generally accepted to evaluate the effects of land consolidation [18]. The methodology varies from country to country due to differences in natural and social conditions and the different objectives of land policy, and in most cases, depends on the availability of data [17, 19]. Descriptive definition criteria, is described as follows: "The criterion is a measure to the same point of view of assessing individual decision" [20].

Based on analyses of numerous studies, and professional and scientific literature reviews [12,18,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35], a team of experts in the field of land consolidation from the Faculty of Technical Sciences in Novi Sad (Serbia) has defined and proposed key ranking criteria listed below [12]:

f1: Share of arable land in total area of agricultural land;
f2: The average size of the land in vacant areas;
f3: The average number of parcels per immovable property;
f4: The average area of land in vacant areas;
f5: Percentage of individual farmers with the property greater than 5 he;
f6: The share of state ownership in the total area of vacant region;
f7: Size of state owned land, which is leased;
f8: Area under the channel network;
f9: Active agricultural population;
f10: Condition for land consolidation

From a larger list of criteria, using the Delphi method, criteria with the highest character were selected, while validation was performed through the analysis of more than 30 land consolidation projects implemented on the territory of Serbia, Croatia, Bosnia and Herzegovina, Romania, Hungary, Finland, and Turkey. Upon research, a connection was made between these risk factors and effects that are achieved through implementation of land distribution projects (Figure 1).

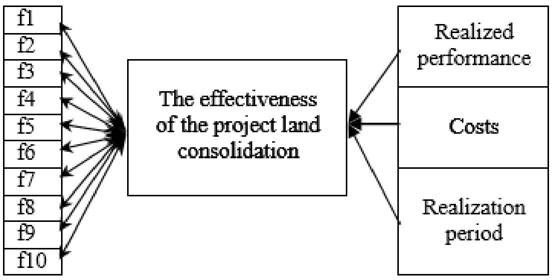

Figure 1. Factors that influence the effectiveness of the land consolidation project [12]

Defining the importance of individual criteria

Different criteria used for the decision-making process do not have equal importance. Therefore, it is necessary to define and assign values of importance to reflect their relative importance. In this study, based on the expert opinions, the criteria values of importance are calculated by using the AHP consensus model [36,37].

It should be noted that the basis for the use of the AHP consensus model for assigning criteria importance value coefficients depends on the specificities of climate conditions where land consolidation projects are implemented.

Defining the decision matrix

After assigning importance to criteria, it is necessary to form a decision-making matrix. Due to the complexity of the problem, the decision matrix is formed based on a large quantity of collected data in cadastral municipalities, from several relevant organizations and institutions (Republic Geodetic Authority, Ministry of Agriculture, Forestry and Water Management, the Ministry of Public Administration and Local Government, Department of Statistics and a local government unit).
In Table 1, the decision-making matrix for ranking cadastral municipalities and the agricultural land by land management in the municipality Pećinci is shown.

Table 1. Decision matrix

Criterion	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9	f_{10}
Units	%	ha/parc	parc/LN	ha/LN	%	%	%	m/ha	%	Un.No.
Weight	0.216	0.216	0.049	0.084	0.139	0.049	0.084	0.049	0.084	0.031
The aim	max	Min	max	Max	max	max	max	min	max	max
Alternative										
Ašanja	75.30	1.40	3.08	4.32	8.89	36.31	54.54	28.36	46.61	0.00
Brestač	81.64	1.11	3.02	3.35	17.70	10.42	29.94	46.30	74.61	1.00
Deč	70.53	1.55	2.02	3.12	8.27	24.60	72.72	39.24	29.90	0.00
D.Tovarnik	86.98	1.46	3.51	5.11	19.85	33.74	75.98	39.98	46.25	0.00
Karlovčić	77.11	1.16	3.74	4.33	16.64	27.30	76.36	44.31	35.47	0.00
Kupinovo	16.70	3.50	3.39	11.88	7.42	79.62	0.16	9.59	43.92	0.00
Obrež	27.96	4.92	3.15	15.50	12.35	56.14	6.32	43.67	50.87	0.00
Ogar	54.78	2.04	3.31	6.76	11.61	48.92	32.07	46.11	45.50	0.00
Pećinci	80.63	0.58	3.44	2.01	9.50	13.40	6.48	28.33	25.28	1.00
Popinci	75.18	0.77	3.42	2.64	11.39	6.87	27.04	17.91	65.84	1.00
Prhovo	71.21	0.74	3.85	2.87	10.99	15.12	87.66	35.69	65.48	1.00
Sibač	85.11	1.26	3.52	4.45	19.85	26.13	53.89	42.79	61.50	0.00
S Mihaljevci	81.70	1.05	3.63	3.82	16.52	16.58	55.19	37.13	65.91	1.00
Subotište	86.27	1.52	2.66	4.05	16.06	24.91	64.18	40.14	54.96	0.00
Šimanovci	67.57	1.04	2.78	2.90	11.63	10.04	42.89	10.37	20.18	0.00

Applied methods of multi-criteria analysis

To rank cadastral plots in the Municipality of Pećinci, the TOPSIS, AHP, PROMETHEE, ELECTRE, SAW, and VIKOR methods were used. A mathematical model for applied multi-criteria methods is described in many scientific papers [13,36,37,38,39,40,41]. Having this in mind, their detailed description is omitted here.

Model of integrated assessment of land consolidation projects

A ranking list of alternatives in the decision-making process can be formed using various methods. In addition, different methods may give different rankings. Thus, even when the methods to be applied in the selection of alternatives are being chosen, the election result is influenced. Therefore, during the analysis of decision making problems it is necessary to accurately identify the decision-making criteria, relative importance of these criteria, the type of information available to decision makers, as well as the desired decision interpretation in the proposal (in this case 6 methods were considered).

Aimed to determine two or more multi-criteria methods to rank cadastral municipalities, a team of experts in the field of land consolidation from the Faculty of Technical Sciences in Novi Sad has defined criteria for integrated assessment of land redistribution projects, as well as a combination of the quality criteria applied in the selection method (limit values), based on the analysis of numerous studies, scientific literature, and actual land redistribution projects:

1. The average standard deviation of an alternative rank for analysed methods should be:

$$\bar{\sigma}_i \leq 1.5 \quad (1)$$

2. The absolute value of the maximum absolute value of the differences between the rankings of individual alternative methods must not exceed a value greater than 15% of the total number of alternatives:

$$d_{c\,max} \leq 2.25 \quad (2)$$

3. Spearman's rank correlation coefficient

A stable interval indicates that the rank orders are associated with strong bond correlation [12]. Spearman's correlation coefficient should be located within the limits of:

$$0.9 \leq r_s \leq 1 \quad (3)$$

The methodology for integrated assessment of land consolidation projects is presented in detail in the paper [12].

CASE STUDY: MUNICIPALITY OF PECINCI, THE REPUBLIC OF SERBIA

By using mathematical models of the SAW, AHP, VIKOR, PROMETHEE, ELECTRE, and TOPSIS methods for making the matrix (Table 1), also taking into account the criteria importance value coefficients, the ranking lists of alternatives are calculated (cadastral municipalities) for all of the observed individual methods (Table 2).

To determine the final rankings of cadastral municipalities for initiating land consolidation projects in Pećinci by using two or more multi-criteria methods for ranking, the model described in Section 2.2.was used and after forming the matrix for the ranges of the methods (Table 2), the compliance of the calculated values with the set criteria was tested.

I Iteration

Table 2 gives an overview of the ranking results and standard deviation according to the alternatives generated through applied methods. In addition, the absolute value of the difference between ranks of individual alternatives of applied methods is given in Table 3. Moreover, the values of the Spearman rank correlation coefficients between the methods are summarized in the Table 4.

According to the obtained results (Table 2), we can conclude that the ranking results obtained using the six methods can be used as a common basis for the determination of the final rankings alternatives, since the given criteria $\sigma_{pros} = 0{,}850 \ < 1.5$ is satisfied.

Based on the analysis of the results obtained (Table 3), it was noted that the absolute value of the maximum difference rank of certain alternatives in methods T-A, T-S, A-P, A-E, A-S, P-S, the E-S and S-V, exceed the limited value.

Table 2. Summary table of alternative rankings and standard deviations - I iterations

Methods	TOP	AHP	PRO	ELE	SAW	VIK	
Alternative	Rang	Rang	Rang	Rang	Rang	Rang	σ
Ašanja	10	9	10	10	10	9	0.52
Brestač	6	4	5	5	5	4	0.75
Deč	12	15	12	12	12	13	1.21
D Tovarnik	2	2	3	2	3	1	0.75
Karlovčić	5	7	6	6	7	6	0.75
Kupinovo	14	14	15	14	15	14	0.52
Obrež	15	13	14	15	14	15	0.82
Ogar	13	10	13	13	13	12	1.21
Pećinci	9	12	9	9	8	10	1.38
Popinci	7	8	7	7	6	8	0.75
Prhovo	4	5	4	4	1	5	1.47
Sibač	3	3	2	3	4	2	0.75
Sr Mihaljevci	1	1	1	1	2	3	0.84
Subotište	8	6	8	8	9	7	1.03
Šimanovci	11	11	11	11	11	11	0
						σ_{pros}	0.85
						σ_{max}	1.47

Table 3. Ranking differences between alternatives generated through applied methods - I iterations

Difference	T-A	T-P	T-E	T-S	T-V	A-P	A-E	A-S	A-V	P-E	P-S	P-V	E-S	E-V	S-V
Alternative															
Ašanja	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1
Brestač	2	1	1	1	2	1	1	1	0	0	0	1	0	1	1
Deč	3	0	0	0	1	3	3	3	2	0	0	1	0	1	1
D Tovarnik	0	1	0	1	1	1	0	1	1	1	0	2	1	1	2
Karlovčić	2	1	1	2	1	1	1	0	1	0	1	0	1	0	1
Kupinovo	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1

Obrež	2	1	0	1	0	1	2	1	2	1	0	1	1	0	1
Ogar	3	0	0	0	1	3	3	3	2	0	0	1	0	1	1
Pećinci	3	0	0	1	1	3	3	4	2	0	1	1	1	1	2
Popinci	1	0	0	1	1	1	1	2	0	0	1	1	1	1	2
Prhovo	1	0	0	3	1	1	1	4	0	0	3	1	3	1	4
Sibač	0	1	0	1	1	1	0	1	1	1	2	0	1	1	2
SMihaljevci	0	0	0	1	2	0	0	1	2	0	1	2	1	2	1
Subotište	2	0	0	1	1	2	2	3	1	0	1	1	1	1	2
Šimanovci	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Σd_i	20	6	2	14	14	20	18	26	14	4	10	14	12	12	22
d_{max}	3	1	1	3	2	3	3	4	2	1	3	2	3	2	4

Table 4. Values of Spearman's rank correlation coefficients - I iteration

Methods	TOP	AHP	PRO	ELE	SAW	VIK
TOP	1	0.92	0.99	1	0.96	0.97
AHP	0.92	1	0.93	0.93	0.88	0.96
PROM	0.99	0.93	1	0.99	0.97	0.97
ELEC	1	0.93	0.99	1	0.97	0.98
SAW	0.96	0.88	0.97	0.97	1	0.92
VIKOR	0.97	0.96	0.97	0.98	0.92	1

Results of ranking obtained using these six methods cannot be used as a common basis for determining the final alternative ranking because other criteria ($d_{max} \geq 2.25$) was not satisfied.

However, the maximum absolute value of the differences between the ranking of individual alternative methods T-B, T-E, T-V, E-P, P-V-V and E does not exceed the limit value. Based on the analysis results (Table 4), it is possible to deduce that the value of the Spearman rank correlation coefficients between the methods of AHP and SAW exceeds the limit value (r_s $0.875 \leq 0.9$).

Furthermore, Spearman's correlation coefficient indicates a strong correlation between ranks obtained by applying the methods TOPSIS, PROMETHEE, ELECTRE, and VIKOR (the result of Spearman's correlations coefficient is greater than 0.95).

Based on the above findings, to establish two or more methods that can be further discussed and represent a common basis for determining the final rankings, the AHP and SAW methods should be excluded from further consideration.

For this reason, the second iteration was performed without discussion, as well as the analysis of these two methods. We also tested whether the combination of other methods (TOPSIS, PROMETHEE, ELECTRE, and VIKOR method) meets the required criteria.

II Iteration

The second iteration of the integral evaluation of the land consolidation projects is conducted with TOPSIS, PROMETHEE, ELECTRE and VIKOR methods. Table 5 provides an overview of the ranking and standard deviation of alternatives among the mentioned methods. In addition, the absolute value of the difference between the individual rankings of alternative methods is given in Table 6. Likewise, Table 4 provides an insight into the values of the Spearman rank correlation coefficient between the used methods.

Per the analysis results given in Table 5, we can conclude that the ranking results obtained by applying these four methods may be used as a common basis for determining the final alternative ranking, since the given criteria $\sigma_{pros} = 0{,}55 < 1.5$ is satisfied.

Based on the analysis of the results obtained in Table 6, we can conclude that the required criteria ($d_{max} \leq 2.25$) was also satisfied. In addition, Spearman's rank correlation coefficients between the four methods used were found to be within the limits $0.9 \leq r_s \leq 1$, which means that this criterion was also satisfied (Table 7).

Table 5. Summary table of alternative rankings and standard deviations - II iterations.

Methods	TOP	PRO	ELE	VIK	
Alternative	Rang	Rang	Rang	Rang	Σ
Ašanja	10	10	10	9	0.50
Brestač	6	5	5	4	0.82
Deč	12	12	12	13	0.50
D Tovarnik	2	3	2	1	0.82
Karlovčić	5	6	6	6	0.50
Kupinovo	14	15	14	14	0.50
Obrež	15	14	15	15	0.50
Ogar	13	13	13	12	0.50
Pećinci	9	9	9	10	0.50
Popinci	7	7	7	8	0.50
Prhovo	4	4	4	5	0.50
Sibač	3	2	3	2	0.58
Sr Mihaljevci	1	1	1	3	1.00
Subotište	8	8	8	7	0.50
Šimanovci	11	11	11	11	0.00
				σ_{pros}	0.55
				σ_{max}	1.00

Table 6. Ranking differences between alternatives generated through applied methods - II of iterations

Difference	T-P	T-E	T-V	P-E	P-V	E-V
Alternative						
Ašanja	0	0	1	0	1	1
Brestač	1	1	2	0	1	1
Deč	0	0	1	0	1	1
D Tovarnik	1	0	1	1	2	1
Karlovčić	1	1	1	0	0	0
Kupinovo	1	0	0	1	1	0
Obrež	1	0	0	1	1	0
Ogar	0	0	1	0	1	1
Pećinci	0	0	1	0	1	1
Popinci	0	0	1	0	1	1
Prhovo	0	0	1	0	1	1
Sibač	1	0	1	1	0	1
Sr Mihaljevci	0	0	2	0	2	2
Subotište	0	0	1	0	1	1
Šimanovci	0	0	0	0	0	0
Σd_i	6	2	14	4	14	12
d_{max}	1	1	2	1	2	2

Table 8. Definite ranking matrix and final ranking of the cadastral municipality land redistribution to launch projects in the Municipality of Pećinci

Methods	TOPSIS	PROMET.	ELECTR	VIKOR			Final rang	
Alternative	rang	rang	rang	rang	sum	rang	Alternative	rang
Ašanja	10	10	10	9	39	10	Sr Mihaljevci	1
Brestač	6	5	5	4	20	5	D Tovarnik	2
Deč	12	12	12	13	49	12	Sibač	3
D Tovarnik	2	3	2	1	8	2	Prhovo	4
Karlovčić	5	6	6	6	23	6	Brestač	5
Kupinovo	14	15	14	14	57	14	Karlovčić	6
Obrež	15	14	15	15	59	15	Popinci	7
Ogar	13	13	13	12	51	13	Subotište	8
Pećinci	9	9	9	10	37	9	Pećinci	9
Popinci	7	7	7	8	29	7	Ašanja	10
Prhovo	4	4	4	5	17	4	Šimanovci	11
Sibač	3	2	3	2	10	3	Deč	12
Sr Mihaljevci	1	1	1	3	6	1	Ogar	13
Subotište	8	8	8	7	31	8	Kupinovo	14
Šimanovci	11	11	11	11	44	11	Obrež	15

Based on the above, we can conclude that in this case, the ranking obtained with the methods TOPSIS, PROMETHEE, ELECTRO and VIKOR, may represent a common basis for determining the final alternative ranking, which are respectively, cadastral plots for the agricultural land development through land management in the municipality of Pećinci.

To make the final decision, which includes considering all the methods that meet the required criteria, a definite ranking matrix was formed (Table 8).

The final ranking list of alternatives (Table 8) is formed based on values obtained by summing up the ranks of the new criteria, so that a smaller summation defines a better position or, in other words, ranks the cadastral municipality in terms of land redistribution to launch projects in the Municipality of Pećinci better.

The final rank list of alternatives (Table 8), which is obtained by the application of the model of integrated evaluation based on the result of ranking by using the method TOPSIS, PROMETHEE, ELECTRE and VIKOR, indicates the priority of the regulation of agricultural land by land management Pećinci should be given to the cadastral municipality Sremski Mihaljevci.

DISCUSSION AND CONCLUSIONS

In the process of providing and allocating funds to initiate and implement land redistribution projects, an important role is played by proper and fair selection of municipalities (at state level) and cadastral municipalities (at the state and local levels), where land consolidation projects will be implemented. Currently, these processes are spontaneous and come without specific explanation of how and why some municipalities or cadastral municipalities get priority over another, because of the social system of Southeast European countries in the second half of the twentieth century.

The methodology applied has an advantage compared to the current applied methodology to a certain extent, which is reflected in the fact that for the first time in the process of giving priority to the Municipalities or Land consolidation projects, ranking the alternative is determined by a combination more criteria optimization, thereby reducing the risk of potentially making wrong decisions when choosing.

To form a model for the integrated assessment of the selection of cadastral municipalities for running land redistribution projects at a local level (municipality Pećinci - sample for model verification), 10 criteria based on which the ranking of 15 alternatives or cadastral municipalities was carried out were a result of the research performed. In doing so, based on a large amount of collected data, we analysed individual criteria for each alternative (cadastral), and carried out the evaluation of the criteria. Due to this, the given criteria do not have the same impact on the evaluation of alternatives, using the AHP consensus model, they are assigned to a corresponding importance value coefficients.

Through the analysis method of multi-criteria analysis and decision-making, the TOPSIS, AHP, PROMETHEE, ELECTRE, SAW and VIKOR methods were selected. By using mathematical models of the above methods on the defined model of integrated evaluation, cadastral municipalities of the selected sample were ranked.

In order to reduce the risk of erroneous decision making processes, integral evaluating land consolidation projects and defining an adequate model for its implementation, that would allow the final ranking obtained by applying at least two or more of the methods with the aim of a more regular, fair and objective selection of the municipality (at the state level) and cadastral municipalities (at the state and local levels),in which land consolidation projects will be initiated and implemented, is needed.

The result of this work lies precisely in the definition and evaluation of integrated assessment models of land redistribution projects. By using an empirical verification of the defined model of land consolidation projects integrated evaluation, it has been concluded that a combination of ranks obtained by applying TOPSIS, PROMETHEE, ELECTRE and VIKOR method meets the defined criteria, and as such can form the basis for the determination of the final rankings. The final ranking is determined based on the ranking results, obtained by these methods, which indicates the priority of the regulation of agricultural land by land management Pećinci, should be given cadastral municipality Sremski Mihaljevci.

The proposed methodology is based on a defined model and TOPSIS, AHP, PROMETHEE, ELECTRE, SAW and VIKOR methods, and can significantly help the decision maker in selecting municipalities or cadastral municipalities to initiate land redistribution projects. The methodology may include any number of criteria and offers a more objective, simpler and more consistent approach to ranking. This methodology can be applied in the evaluation and ranking different sets of alternative municipalities or cadastral municipalities. It should also be noted that the selection of municipalities or cadastral municipalities, according to local governments and the attitudes of the state administration, can be based on different criteria and methods of multi-criteria optimization, not only on those that have been proposed and used in the work.

A significant challenge of land consolidation projects is to establish the relation between the need for land consolidation and the economic viability of the project. If financial constraints, typical for all the necessary processes and sub-processes, comply and a feasibility study confirms positive assessment, it is possible to develop a program for planning and implementation of land consolidation project. However, at the beginning stage of project development, it is quite difficult to choose a local government that prioritizes enforceable land consolidation projects by applying classical methods. The character of the shown methods and the case study results exactly represent the main contribution and research aim of this paper. Improving the methodology for optimizing the ranking of municipalities and land redistribution projects analysed in this paper, allows administrative bodies, local authorities and other stakeholders the possibility to make objective decisions, efficient and cost-effective allocation of resources, as well as provides a guide for setting priorities in the selection of municipalities and cadastral plots for the development of agricultural land by land consolidation.

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