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THE NEED TO CONSOLIDATE LAND IN VILLAGES OF CENTRAL POLAND BASED ON THE EXAMPLE OF ZHARNOVSKAYA COMMUNITY

ЖАРНОВ КОММУНАСЫНЫҢ МЫСАЛЫНДА ОРТАЛЫҚ ПОЛЬША АУЫЛДАРЫНДАҒЫ ЖЕРЛЕРДІ ШОҒЫРЛАНДЫРУ ҚАЖЕТТІЛІГІ

НЕОБХОДИМОСТЬ КОНСОЛИДАЦИИ ЗЕМЕЛЬ В ДЕРЕВНЯХ ЦЕНТРАЛЬНОЙ ПОЛЬШИ НА ПРИМЕРЕ ЖАРНОВСКОЙ КОММУНЫ

***JUSTYNA WÓJCIK-LEŃ*[1]**
Ph.D
***KAROL NOGA*[2]**
Professor
***KAROL OŻÓG*[3]**
Master of Science
PRZEMYSŁAW LEŃ*[4]
Ph.D, Associate Professor
[1]*Department of Environment and Agriculture, Discrit Authority Office in Brzozow, Poland*
[2]*Department of Geodesy and Geotechnics, Rzeszow University of Technology, Poland*
[3]*City Property Management Office of Rzeszow, Poland*
[4]*Department of Environmental Engineering and Geodesy, University of Life Sciences in Lublin, Poland*
**corresponding author e-mail: przemyslaw.len@up.lublin.pl*

***ЖУСТИНА ВОЖЧИК-ЛЕН*[1]**
Ph.D
***КАРОЛ НОГА*[2]**
профессор
***КАРОЛ ОЗОГ*[3]**
ғылым магистрі
ПРЖЕМИСЛАВ ЛЕН*[4]
Ph.D, доцент
[1]*Қоршаған орта және ауыл шаруашылығы факультеті, Бжозувадағы аудандық департамент, Польша*
[2] *Геодезия және геотехника факультеті, Жешув технологиялық университеті, Польша*
[3] *Қалалық жылжымайтын мүлікті басқару кеңсесі, Жешув, Польша,*
[4]*Инженерлік экология және геодезия факультеті, Люблиндегі жаратылыстану ғылымдары университеті, Польша*
**автордың электрондық поштасы: przemyslaw.len@up.lublin.pl*

***ЖУСТИНА ВОЖЧИК-ЛЕН*[1]**
Ph.D
***КАРОЛ НОГА*[2]**
профессор
***КАРОЛ ОЗОГ*[3]**
Магистр наук
ПРЖЕМИСЛАВ ЛЕН*[4]
Ph.D, доцент
[1]*Факультет окружающей среды и сельского хозяйства,*
Районный департамент в Бжозуве, Польша
[2]*Факультет геодезии и геотехники, Жешувский технологический университет, Польша*
[3]*Офис управления городской недвижимостью, Жешув, Польша,*
[4]*Факультет инженерной экологии и геодезии,*
Университет естественных наук в Люблине, Польша
**электронная почта автора: przemyslaw.len@up.lublin.pl*

Abstract. The article notes that in rural areas, re-development is necessary to ensure the sustainable development of specific area. The authors believe that it is possible to improve the farm structure by enlarging them by combining small business entities or providing another land plot in exchange. Such works will result in achievement of the desired structural change, only if it is implemented systematically and becomes a permanent element of long-term rural administration policy. Measures related to the consolidation and equivalent exchange of land plots should be introduced comprehensively and unambiguously in combination with subsequent development of such territories. Only then can the intended goal be fully achieved, that is, improvement of their spatial structure. Taking into account the limited funds, it is necessary to develop a strategy in order to identify the regions for community, districts or voivodships in which such activities should be carried out on a priority basis. Determination of lands for unification must be well thought, rational and, above all, it is necessary that the effect of such work brings measurable results for the country's agricultural policy. The survey ranked 32 characteristics which are specific to each village using the zero unitarization method and Hellwig method. The results of surveys carried out in 41 settlements of the Zharnovskaya community with a total area of 14 106.91 hectares, divided into 22 638 cadastral plots, are presented. The study area is located in central Poland.

Аңдатпа. Мақалада белгілі бір аумақтың тұрақты дамуын қамтамасыз ету үшін ауылдық жерлерде қайта құру қажет екендігі айтылған. Авторлар шаруашылықтардың құрылымын ұсақ шаруашылық жүргізуші субъектілерді біріктіру немесе олардың орнына басқа жер учаскесін беру арқылы ірілендіру арқылы жақсартуға болады деп санайды. Мұндай жұмыстар жүйелі түрде жүзеге асырылатын және ауылдық жерлерде ұзақ мерзімді басқару саясатының тұрақты элементі болған жағдайда ғана қажетті құрылымдық өзгерістерге қол жеткізуге әкеледі. Жер учаскелерін ірілендірумен және тең бағамен айырбастаумен байланысты шаралар кешенді түрде және осындай аумақтарды кейіннен салумен ұштастыра отырып, бір мәнді енгізілуге тиіс. Сонда ғана мақсатқа толық қол жеткізуге болады, яғни олардың кеңістіктік құрылымын жақсарту. Қаражаттың шектеулілігін назарға ала отырып, мұндай іс-шаралар басым тәртіппен орындалуға тиіс коммуна, аудандар үшін өңірлерді айқындау мақсатында стратегия әзірлеу қажеттілігі туындайды. Біріктіру үшін жерді анықтау әдейі, ұтымды болуы керек және, ең алдымен, мұндай жұмыстардың әсері елдің ауылшаруашылық саясатына өлшенетін нәтиже беруі керек. Сауалнама нөлдік унитаризация әдісі мен Хеллвиг әдісін қолдана отырып, әр ауылға тән 32 ерекшеліктің рейтингісін жүргізуге мүмкіндік берді. 22 638 кадастрлық учаскелерге бөлінген, жалпы ауданы 14 106,91 га Жарнов коммунасының 41 елді мекенінде жүргізілген зерттеулердің нәтижелері ұсынылған. Зерттеу аймағы Польшаның орталық бөлігінде орналасқан.

Аннотация. В статье отмечается, что в сельских районах необходима перепланировка для обеспечения устойчивого развития конкретной территории. Авторы считают, что возможно улучшение структуры хозяйств за счет их укрупнения путем объединения мелких субъектов хозяйствования либо предоставления в обмен другого земельного участка. Такие работы приведут к достижению желаемых структурных изменений только в том случае, если они будут осуществляться систематически и станут постоянным элементом долгосрочной политики управления в сельской местности. Меры, связанные с укрупнением и равноценным обменом земельными участками, должны вводиться комплексно и однозначно в сочетании с последующей застройкой таких территорий. Только тогда можно в полной мере достичь намеченной цели, то есть улучшения их пространственной структуры. Принимая во внимание ограниченность средств, возникает необходимость в разработке стратегии в целях определения регионов для коммуны, районов или воеводств, в которых такие мероприятия должны выполняться в приоритетном порядке. Определение земель для объединения должно быть обдуманным, рациональным и, прежде всего, необходимо, чтобы эффект от таких работ приносил измеримые результаты для сельскохозяйственной политики страны. Опрос позволил провести ранжирование 32 особенностей, характерных для каждого села, с использованием метода нулевой унитаризации и метода Хеллвига. Представлены результаты обследований, проведенных в 41 населенном пункте Жарновской коммуны общей площадью 14 106,91 га, разделенных на 22 638 кадастровых участков. Район исследования расположен в центральной части Польши.

Key words: rural area, enlargement of farms by combining small land plots, spatial structure of agricultural land, map of the location of analyzed objects, ranking of territories.

Түйінді сөздер: ауылдық жерлер, ұсақ жер учаскелерін біріктіру есебінен шаруашылықтарды ірілендіру, ауыл шаруашылығы алқаптарының кеңістіктік құрылымы, талданатын объектілердің орналасу картасы, аумақтарды саралау

Ключевые слова: сельская местность, укрупнение хозяйств за счет объединения мелких земельных участков, пространственная структура сельскохозяйственных угодий, карта расположения анализируемых объектов, ранжирование территорий.

Introduction. The area structure of present-day villages in Poland has been shaped by the long-term settlement activity of society. Human settlement contributed to the emergence of various forms of land use for manufacturing, transportation and building development, creating small farms that are scattered over an extensive area and are irregularly shaped. Continuing divisions of ownership due to inheritance, and stymied migration processes have resulted in a defective structure of rural areas in many regions of Poland.

Agriculture in central Poland is characterised by excessive fragmentation of land with scattered plots of unfavourable shapes. These elements are obstacles to profitable agricultural production. The network of roads directly accessing fields is not accessible to state-of-the-art agricultural equipment. In addition, land situated in the eastern [20], [23] and south-eastern [17], [22], [7] part of Poland also features a high level of defectiveness, which has a negative effect on building a full-featured real property cadastre [14], [15], [3].

The problem of unfavourable structure of arable land is present in many countries in Europe and in the world. It is due to historical, social and economic transformations that have continued for decades [4], [2], [18], [5].

One element of agricultural policy is rural management works programming. Identification of agricultural land for land consolidation works at a national level or regional level is a difficult and time-consuming task [6], [11]. Land consolidation works are a tool helping to improve farm operation but also an element of a comprehensive system of development of rural areas [16]. The works have a very long history not only in Europe [18], [21] but also in Asian countries [12], [13]. Identification of land for consolidation should be deliberative, rational and primarily the effect of such works should bring measurable results for the agricultural policy of the analysed country [25].

The structure of farms may be improved by land consolidation and exchange works. Considering the limited funds allocated to the above-mentioned measures, a need arises to develop a strategy to identify the areas of communes, districts or voivodeships where such works should be carried out as a priority.

Polish legislation [24] defines the process of consolidation as a rural management procedure aiming at transformation of the spatial arrangement of rural land in order to create more favourable management conditions by improving the territorial structure of farms, ensuring reasonable configuration of land, and aligning the limits of real properties with the system of water irrigation structures, roads and terrain. On the other hand, the Rural Development Programme (RDP) describes land consolidation as works during which new plots are formed in a configuration different from that of original plots in order to reduce the number of small, scattered plots constituting a single farm and to increase their average size. The consolidation project also includes works related to post-consolidation management of land, that is, in particular, creating a functional system of access roads to agricultural land and forestland and performing tasks affecting the regulation of the water regime in the consolidated area. Consolidation of land leads to rearrangement of farms and improves the configuration of land through: reducing the number of plots, increasing plot surface area, decreasing the distance between the plots and the farmer's dwelling and altering their irregular shape.

This paper aims to determine the urgency of land consolidation and exchange works in 41 villages of the Opoczno commune in Łódź voivodeship, central Poland (figure 1). The study area covers 14 106.91 ha divided into 22 638 plots of land. In order to create a ranking of urgency of land consolidation and exchange this work makes use of multidimensional statistics.

The outcomes of surveys are based on computational algorithms using the zero unitarization method and Hellwig's method. The calculations were based on data from a real property register maintained by the District Administrator's Office in Opoczno tabulated as 32 features specific to the study area.

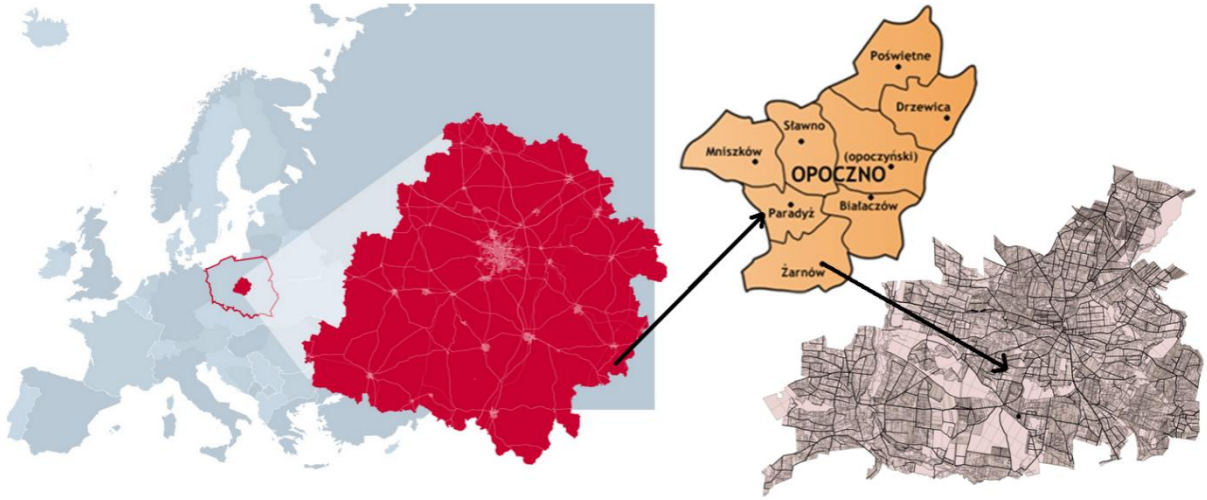

Figure 1- Map of location of the analysed objects

Material and methods of research.

For the purposes of land consolidation and exchange works in the commune of Żarnów, 32 features characteristic of respective precincts were identified and calculated. The first group comprises factors describing general information about the analysed precincts in the commune such as: x_1- total surface area, x_2 - total number of plots, x_3- number of residents, x_4 - number of residents per km^2, x_5 - % of the surface area of plots owned by individual farmers, x_6 - % of the number of plots owned by individual farmers, x_7 - average surface area of a plot. The second group is features related to land owned by individual farmers such as: x_8 - number of registration units 7.1, x_9 - % of registration units 7.1, x_{10} - number of plots per registration unit 7.1, x_{11} - surface area of plots per registration unit 7.1, x_{12}- % of the number of plots 7.1 in relation to group 7, x_{13}- % of the surface area of plots in relation to group 7, x_{14}- average number of plots per registration unit, x_{15} - average surface area of a registration unit, x_{16} - fragmentation ratio. Another group refers to the productivity ratio and includes features such as: x_{17} - arable land, x_{18} - grassland. The fourth group comprises features associated with the ownership structure, including: x_{19} - % of land owned by the Agricultural Property Agency of the State Treasury, group 1.1, x_{20} - land owned by communes. The fifth group, applicable to plots without access to roads, consists of: x_{21}- % of the number of plots without access to roads, x_{22}- % of the surface area of plots without access to roads. Group six is made of features regarding the structure of land use, namely: x_{23}- % of orchards, x_{24}- % of forests. The last group of factors are: x_{25}- % of the number of plots below the elongation ratio value 1.00, x_{26}- % of the area of plots below the elongation ratio value 1.00, x_{27}- % of the number of plots with elongation ratio values 1.01-2.00, x_{28}- % of the area of plots below elongation ratio values 1.01-2.00, x_{29}- % of the number of plots with elongation ratio values 2.01-3.00, x_{30}- % of the area of plots below elongation ratio values 2.01-3.00, x_{31}- synthetic ratio of plot elongation for the precinct, x_{32}- average elongation ratio. The 32 features are listed in table No. 1.

Preliminary analysis refers to a general description of the distribution of values of respective variables presented in the form of descriptive statistics (table 1). For the needs of the consolidation process each variable was described as either a stimulant (larger-the-better characteristic) or destimulant (smaller-the-better characteristic). There were 27 stimulants and 5 destimulants.

Prior to developing a synthetic ranking based on output values of diagnostic features, they are usually subject to general selection. The criterion applied often excludes variables taken into account in the analysis for which the value of variation coefficient (V) is less than 20%. Based on the analysed features, in terms of the variation coefficient, the adopted criterion was not met for: % of the number of plots owned by individual farmers (V=17.04), % of registration units from group 7.1 (V=12.83), % of the number of plots from group 7.1 in relation to group 7 (V=14.35), % of the surface area of plots in relation to group 7 (V=6.87), and the plot fragmentation ratio (V=11.56). Nevertheless, it was decided that these variables should be taken into account due to the importance of the information they carry.

Table 1 - Features adopted for the survey as stimulants and destimulants

Selected features		Mean	Min.	Max.	Median	Variance	Standard deviation	Coefficient of variation
Stimulants	x_1- total surface area [ha]	344.07	27.89	962.33	279.27	49 990.59	223.59	64.98
	x_2- total number of plots	681.17	62.00	2 275.00	534.00	289 530.20	538.08	78.99
	x_3- number of residents	157.15	7.00	1 149.00	105.00	39 045.98	197.60	125.74
	x_4- number of residents per 1km2	41.31	2.92	144.34	36.88	1 001.13	31.64	76.59
	x_5- % of the surface area of land owned by individual farmers	78.93	25.58	98.39	86.06	380.30	19.50	24.71
	x_6- % of the number of plots owned by individual farmers	81.79	35.19	96.53	86.35	194.33	13.94	17.04
	x_7- average surface area of a plot [group 7]	0.63	0.19	2.77	0.51	0.19	0.43	68.65
	x_8- number of registration units from group 7.1	127.49	21.00	542.00	111.00	9 991.16	99.96	78.40
	x_9- % of registration units from group 7.1	74.34	53.49	88.52	76.32	90.97	9.54	12.83
	x_{10}- number of plots per registration unit from group 7.1	519.39	46.00	1 480.00	384.00	152 447.54	390.45	75.17
	x_{11}- surface area of plots per registration unit from group 7.1	253.87	27.89	727.91	217.71	30 500.18	174.64	68.79
	x_{12}- % of the number of plots in group 7.1 in relation to group 7	94.80	72.31	133.14	94.23	185.07	13.60	14.35
	x_{13}- % of the surface area of plots in relation to group 7	96.43	83.46	117.04	96.50	43.95	6.63	6.87
	x_{14}- average number of plots per registration unit	4.27	1.57	9.91	3.89	3.83	1.96	45.83
	x_{15}- average surface area of a registration unit	2.13	0.77	4.22	2.07	0.43	0.66	30.88
	x_{16}- arable land	32.92	20.03	48.60	32.67	50.16	7.08	21.51
	x_{17}- grassland	35.77	15.00	45.34	38.04	52.19	7.22	20.20
	x_{18}-% of land owned by the Agricultural Property Agency of the State Treasury, group 1.1	0.75	0.00	2.37	0.57	0.48	0.69	91.71
	x_{19}-% of land owned by communes	2.41	0.00	10.03	1.94	4.23	2.06	85.41
	x_{20}-% of the number of plots without access to roads	16.78	1.39	58.99	13.08	199.53	14.13	84.19
	x_{21}-% of the surface area of plots without access to roads	11.57	0.35	62.44	10.39	138.37	11.76	101.64
	x_{25} -% of the number of plots below the elongation ratio value 1.00	20.49	0.00	55.88	17.50	199.67	14.13	68.95
	x_{26} -% of the surface area of plots below the elongation ratio value 1.00	16.25	0.00	52.09	12.21	200.07	14.14	87.07
	x_{27} -% of the number of plots with elongation ratio values 1.01-2.00	22.29	3.08	49.12	23.53	82.38	9.08	40.72
	x_{28} -% of the surface area of plots below elongation ratio values 1.01-2.00	23.81	2.78	61.99	24.90	173.90	13.19	55.38
	x_{29} -% of the number of plots with elongation ratio values 2.01-3.00	16.45	9.52	24.84	16.26	19.11	4.37	26.57
	x_{30} -% of the area of plots below elongation ratio values 2.01-3.00	17.33	8.28	26.47	16.70	21.44	4.63	26.72
Destimulants	x_{31} - synthetic ratio of plot elongation for the precinct	3.34	1.82	4.95	3.48	0.72	0.85	25.34
	x_{32} - average elongation ratio	2.93	1.53	5.04	2.86	0.58	0.76	25.87
	x_{22} - fragmentation ratio	3.88	2.63	4.74	3.90	0.20	0.45	11.56
	x_{23} - % of orchards	0.84	0.00	3.56	0.71	0.65	0.81	96.11
	x_{24} -% of forests	24.43	0.20	85.08	17.51	376.86	19.41	79.45

The ranking of urgency of land consolidation and exchange in the villages of Żarnów commune was created employing the zero unitarization method and Hellwig's method. These methods have measures in place to classify objects according to their characteristic features and issues related to the object in terms of the analysis of the spatial structure of land carried out in the work [Jędrzejczyk et al. 2002].

Literature reports [8], [9], [10] that the diagnostic variables of objects can be classified as: stimulants, destimulants and nominants. Stimulants are the variables that, when growing in value, increase the rank of a feature of the analysed object. According to the zero unitarization method, the following formula applies to stimulants:

$$Z = \frac{(x - x_{min})}{(x_{max} - x_{min})}$$

On the other hand, destimulants are the variables that, when growing in value, decrease the rank of a feature of the analysed object. According to the zero unitarization method, the following formula applies to destimulants:

$$Z = \frac{(x_{max} - x)}{(x_{max} - x_{min})}$$

where:

z - standardized variable,

x - non-standardized variable,

x_{max} - maximum value of the variable in a specific set,

x_{min}- minimum value of the variable in a specific set.

Standardisation of diagnostic features leads to an overall multi-criterion evaluation of every object. Their overall assessment can be achieved by aggregation. A synthetic measure can be obtained by calculating mean values for sets describing respective features according to the following formula [10], [19]:

$$z_i = \frac{1}{p}\sum_{i=1}^{p} x_{ij} (i = 1, \dots, m)$$

Standardised measures fall within the range <0;1>. The obtained results can be adopted as average values optimum for each object. Thus, the higher the value of a synthetic measure is, the higher the position of the respective object in the developed ranking [10].

The second method used in order to create a ranking of urgency of land consolidation and exchange is Hellwig's method. A strong point of this method is the fact that it combines features of a different nature and ascribes them a comprehensive aggregate measure. This value can be used for an overall comparison of the analysed units, which will form a basis for classifying them into groups of the same kind [1].

At the first stage of calculations, a benchmark with standardised variables is determined:

$$\mathbf{O}_0 = \left[z_{oj}\right], \qquad j=1,2,...,m.$$

The benchmark has coordinates following from the formula:

$$z_{oj} = \max_i \left\{z_{ij}\right\}$$

- when the selected feature is a stimulant

$$z_{oj} = \min_i \left\{z_{ij}\right\}$$

- when the selected feature is a destimulant

The benchmarking method was applied to the resulting features assuming that a benchmark exists with reference to which taxonomic distances are determined for the analysed objects. These distances are calculated using Euclidean metrics:

$$d_{i0} = \left[\sum_{j=1}^{m}\left(z_{ij} - z_{0j}\right)^2\right]^{\frac{1}{2}} \qquad i=1,2,...,m$$

The calculated d_i values were then used to determine Hellwig's synthetic measure of development:

$$s_i = 1 - \frac{d_{i0}}{d_0} \qquad i=1,2,...,m$$

where:

$$d_0 = \bar{d}_0 + 2S\left(d_0\right)$$

whereas:

$$\bar{d}_0 = \frac{1}{n}\sum_{i=1}^{n} d_{i0};$$

$$S\left(d_0\right) = \left[\frac{1}{n}\sum_{i=1}^{n}\left(d_{i0} - \bar{d}_0\right)^2\right]^{\frac{1}{2}}$$

S_i generally is a value from the range <0;1>. The closer these results are to 1, the more similar they are to the benchmark.

Results and their discussion. As a result of calculations using the zero unitarization method and Hellwig's method for which the resulting values of synthetic measures fall within the range <0;1>, the level of the synthetic measure made it possible to identify precincts in which land consolidation works are of the utmost urgency. Land consolidation works should be carried out, in the first place, in precincts listed in table 2, and their spatial distribution is shown on figure 2.

Surveys show that, thanks to the application of two separate methods, two different rankings of urgency of land consolidation and exchange works could be developed. The

same rank was assigned to 4 out of 41 surveyed villages, which accounts for 10 % of all villages. Three precincts, that is, 7 % of the whole analysed commune, differ by one rank in the rankings prepared with the two methods. Villages such as: Ławki, Straszowa Wola, Klew and Żarnów differ by two ranks. Other 3 villages are similar in the analysed rankings by 3 ranks. A difference of 4 ranks is noted for another 4 villages, accounting for 10 % of the whole commune. Then, two villages differ by 5 ranks in the analysed rankings. Skumros, Soczówki, Kamieniec and Pilichowice moved 6 ranks in the ranking. The remaining 17 villages differ subsequently by 7, 8, 9, 10, 11, 12, 13, 17 and 19 ranks. The biggest difference in a synthetic measure is recorded for Sielec which moved by 19 ranks in the compared rankings for both methods. On the other hand, Adamów, Nadole, Niemojowice and Tomaszów maintained their positions in the ranking.

Table 2 -Ranking of villages based on a synthetic measure calculated using the zero unitarization method and Hellwig's method

Ranking position	Zero unitarization method		Hellwig's method	
	Synthetic measure	Name of precinct	Synthetic measure	Name of precinct
1	0.542	Soczówki	0.960	Żarnów
2	0.536	Straszowa Wola	0.652	Topolice
3	0.528	Żarnów	0.647	Pilichowice
4	0.519	Wierzchowisko	0.645	Straszowa Wola
5	0.500	Paszkowice	0.636	Wierzchowisko
6	0.498	Jasion	0.559	Miedzna Murowana
7	0.490	Malków	0.517	Soczówki
8	0.487	Nadole	0.507	Nadole
9	0.486	Pilichowice	0.506	Paszkowice
10	0.484	Niemojowice	0.498	Niemojowice
11	0.484	Topolice	0.479	Skórkowice
12	0.477	Antoniów	0.471	Zdyszewice
13	0.444	Trojanowice	0.394	Klew
14	0.444	Kolonia Klew	0.373	Malków
15	0.436	Klew	0.362	Myślibórz
16	0.433	Skórkowice	0.356	Trojanowice
17	0.431	Zdyszewice	0.349	Grębenice
18	0.423	Miedzna Murowana	0.346	Młynek
19	0.420	Ruszenice	0.343	Budków
20	0.418	Poręba	0.317	Sielec
21	0.409	Adamów	0.307	Adamów
22	0.404	Budków	0.286	Ruszenice
23	0.401	Marcinków	0.286	Jasion
24	0.400	Kolonia Ruszenice	0.282	Marcinków
25	0.395	Dąbie	0.264	Chełsty
26	0.384	Młynek	0.262	Kolonia Klew
27	0.379	Myślibórz	0.249	Bronów
28	0.369	Tomaszów	0.247	Tomaszów
29	0.367	Widuch	0.243	Antoniów
30	0.366	Grębenice	0.234	Dłużniewice
31	0.362	Afryka	0.227	Kolonia Ruszenice
32	0.356	Skumros	0.211	Dąbie
33	0.356	Malenie	0.210	Widuch
34	0.354	Ławki	0.186	Kamieniec
35	0.343	Nowa Góra	0.185	Afryka
36	0.333	Chełsty	0.182	Ławki
37	0.329	Bronów	0.173	Poręba
38	0.327	Dłużniewice	0.168	Skumros
39	0.322	Sielec	0.156	Nowa Góra
40	0.250	Kamieniec	0.156	Siedlów
41	0.171	Siedlów	0.135	Malenie

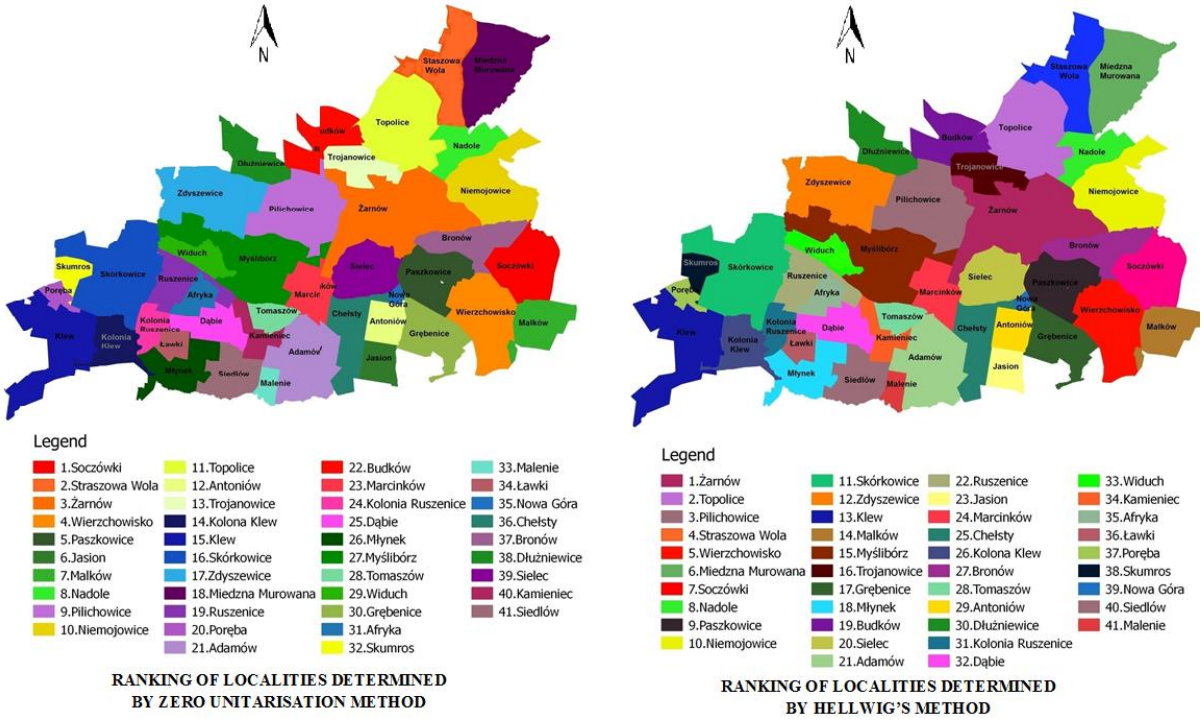

Figure 2 - Spatial distribution of the two rankings

The analysis of rankings leads to a conclusion that consolidation works should be carried out in the first place in Adamów, Nadole, Niemojowice and Tomaszów. The surveyed precincts feature a relatively high percentage of plots in the individual sector compared to the general number of plots, namely - Adamów (87 %), Nadole (81 %), Niemojowice (85 %) and a much lower percentage for the village of Tomaszów (39 %). In Adamów, Nadole and Tomaszów precincts, 34 % of the number of plots have no access to roads.

The largest average surface area of a plot in the individual sector is characteristic of Adamów where the average surface area for 442 plots is 1.0507 ha. On the other hand, the smallest average surface area of a plot in the individual sector was recorded in Nadole – 0.1878 ha, with its 1013 plots.

Conclusions

1. Studies regarding hierarchization of needs to the extent of land consolidation works in the villages of central Poland using the example of Żarnów commune demonstrated that the spatial structure in the analysed area is very defective and must be thoroughly redeveloped.

2. Land consolidation and exchange works in this area are a must. The works are meant to improve the spatial structure of rural areas.

They can also be a factor contributing to faster reforms aiming to transform the land and buildings register in Poland into a full-featured real property cadastre. Therefore, efforts should be taken to carry out land consolidation works. This applies both to local governments and land owners who often oppose such operations. This process will improve spatial parameters including: the number, surface area and shape of plots, number of plots without access, plot width, and reduce the number of plots constituting a farm.

Consolidation also leads to road network improvements, which reduces the time to reach the fields. The above-mentioned actions contribute to an increase in the profitability of agricultural production. It is worth noting that, apart from improved agricultural conditions, the land consolidation processes have additional consequences: welfare and social (increase in the market value of plots), environmental and landscape (amelioration, reclamation), organisational and legal (abolishment of land easements, joint property and common land).

Consolidated grounds become more attractive to tourists and offer better conditions for the development of non-agricultural business. It is impossible to carry out an operation transforming a defective structure across the whole area at the same time, at least due to financial reasons.

3. Thus, such works must be carried out as a priority in villages with the most urgent needs. The developed multi-dimensional statistics considerably facilitate determining the order in which land consolidation and exchange works should be carried out.

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Information about authors:

Justyna Wójcik-Leń; Ph.D; Head of Department; Department of Environment and Agriculture, Discrit Authority Office in Brzozow; 36-200 Brzozow, 51 3 Maja Street, Poland; justynaa.wojcik@wp.pl; https://orcid.org/0000-0002-1130-9156

Karol Noga; Professor; Department of Geodesy and Geotechnics, Rzeszow University of Technology; 35-959 Rzeszow, al. Powstańców Warszawy 12, Poland; rmknoga@cyf-kr.edu.pl; https://orcid.org/0000-0002-4890-9614

Karol Ożóg; Master of Science; City Property Management Office of Rzeszow; 35-002 Rzeszow, place Ofiar Getta, Poland; karol.ozog@gmail.com; https://orcid.org/0000-0002-2464-9010

Przemysław Leń; Ph.D, Associate Professor; Department of Environmental Engineering and Geodesy, University of Life Sciences in Lublin; 20-950 Lublin, 13 Akademicka Street, Poland; przemyslaw.len@up.lublin.pl; https://orcid.org/0000-0003-0810-9986

***Авторлар туралы ақпарат**:*

Жустина Вожчик-Лен; Ph.D; кафедра меңгерушісі; Қоршаған орта және ауыл шаруашылығы факультеті, Бжозувадағы аудандық департамент; Бжозуф қ., 36-200 Майя көшесі 51 3, Польша; justynaa.wojcik@wp.pl; https://orcid.org/0000-0002-1130-9156

Карол Нога; профессор; геодезия және геотехника факультеті, Жешув технологиялық университеті; Жешув қ., 35-959 Варшава көтерілісшілері көшесі 12, Польша; rmknoga @cyf-kr.edu.pl; https://orcid.org/0000-0002-4890-9614

Карол Озог; ғылым магистрі; Қалалық жылжымайтын мүлікті басқару кеңсесі; Жешув қ., 35-002 Гетта Офиары көшесі, Польша; karol.ozog@gmail.com; https://orcid.org/0000-0002-2464-9010

Пржемислав Лен; Ph.D, доцент; Инженерлік экология және геодезия факультеті, Люблиндегі жаратылыстану ғылымдары университеті;Люблин қ., 20-950 Академическая көшесі 13, Польша; przemyslaw.len@up.lublin.pl; https://orcid.org/0000-0003-0810-9986

Информация об авторах:

Жустина Вожчик-Лен; Ph.D; заведующая кафедрой; Факультет окружающей среды и сельского хозяйства, Районный департамент в Бжозуве; г.Бжозуф, 36-200 ул.Майя 51 3, Польша; justynaa.wojcik@wp.pl; https://orcid.org/0000-0002-1130-9156

Карол Нога; профессор; Факультет геодезии и геотехники, Жешувский технологический университет; г. Жешув, 35-959 ул.Повстанцев Варшавы 12, Польша; rmknoga @cyf-kr.edu.pl; https://orcid.org/0000-0002-4890-9614

Карол Озог; магистр наук; Офис управления городской недвижимостью; г. Жешув, 35-002 ул. Офиар Гетта, Польша; karol.ozog@gmail.com; https://orcid.org/0000-0002-2464-9010

Пржемислав Лен; Ph.D, доцент; Факультет инженерной экологии и геодезии, Университет естественных наук в Люблине; г.Люблин, 20-950 ул. Академическая 13, Польша; przemyslaw.len@ up.lublin.pl; https://orcid.org/0000-0003-0810-9986