

THE HIERARCHIZATION OF NEEDS RELATED TO LAND CONSOLIDATION AND EXCHANGE IN RURAL AREAS IN THE VILLAGES OF THE GMINA OF POŚWIĘTNE IN CENTRAL POLAND

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Abstract

Rural areas in Poland are characterized by differentiated spatial structure. In villages located in Central Poland often very defective geometry of plots can be observed along with very defective plot patchwork where the land of owners is considerably scattered inside and outside the village. The spatial structure of rural areas can be improved through the consolidation and exchange of land aiming to (Art.1, Act of 26 March 1982 on consolidation and exchange of land) create more favourable management conditions in agriculture and forestry by improving the territorial structure of farms, forests and forestland, reasonable configuration of land, aligning the limits of real properties with the system of water irrigation facilities, roads and terrain. In connection with such a requirement for the consolidation and exchange of land, a hierarchy of needs and their urgency must be established. Such an approach makes it possible to secure funds for liquidating the spatial structure of agricultural land according to the established urgency. The studies were carried out in the rural gmina of Poświętne, situated in Opoczno powiat in Central Poland, which consisted of 17 villages covering a total area of 14081.0 ha.

Key words: consolidation of land, rural areas, spatial structure, agricultural land

Introduction

Land, being a national wealth, must be properly managed and protected. However, such measures must be taken in compliance with social interest. The improvement of efficiency and creation of conditions to improve the agrarian structure should be preceded by a set of legal and organizational measures (NOGA, 2005). The integration of the European Commonwealth contributed to accession of Poland to the European Union in 2004. Therefore, a possibility arose to develop and promote rural areas since European policy aims at implementing solutions to transform rural land. The above-mentioned policy for the following years to be pursued in rural areas is oriented at extending the functions performed by rural land. In EU member states the restructuring of rural areas based on consolidation is a common measure, thus Poland's membership of the EU provided an opportunity for developing rural areas through the financial support of such measures. The development of agriculture in Poland and its production capacity is much differentiated in terms of space. One of the reasons for this situation is the process of long-term transformations of agricultural management in areas with different social and economic situations continuing for many years (SOBOLEWSKA-MIKULSKA, WÓJCIK, 2012; WÓJCIK-LEŃ, SOBOLEWSKA-MIKULSKA, 2017, WÓJCIK-LEŃ, STRĘK, 2017).

Over centuries the developing division of land in the villages situated in the analyzed territory caused large defects in the spatial structure of rural areas. The present-day rural areas of Central Poland have been affected by multiple factors (WÓJCIK, LEŃ, 2015). This problem also concerns other regions of Poland. Land situated in the eastern part of Poland (KRÓL, NOGA, 2016; STRĘK, 2017) as well as the territory of south-eastern Poland (LEŃ et al., 2016; JANUS et al., 2017, WÓJCIK-LEŃ, STRĘK, 2017, JASIŃSKA, 2017, JANUS, 2018) is characterized by a high degree of defectiveness, which has a negative effect on building a full value cadastre of real properties (HANUS, 2013, DAWIDOWICZ, ŻRÓBEK, 2014, MIKA, 2016, MIKA, 2017, HUDECOVA et al., 2016, DAWIDOWICZ, ŻRÓBEK, 2018, HANUS ET AL., 2018).

Works related to transformation of the spatial structure are determined by many factors: structure of ownership, structure of use of land, fragmentation of land, size of plots, and network of roads, density of population as well as natural, structural and economic and production conditions. The studies make it possible to identify many factors describing respective villages, and hence providing information about the spatial structure of the analyzed land.

This paper aims to analyze the spatial structure in 17 villages in the gmina of Poświętne, situated in Opoczno powiat in Central Poland (Łódź voivodeship), in order to identify a group of factors characterizing each village. In further studies the resulting information will form the basis for developing rankings of the needs for consolidation of land in the analyzed area using statistical methods. The studies aimed to verify the impact of each factor on the position in ranking of urgency of consolidation and exchange of land in each of the analyzed villages. The first ranking did not exclude any of the 26 most significant factors characterizing each of the analyzed villages. Subsequent studies did not take one of the factors into account. The key measure enabling reconstruction of the defective spatial structure is comprehensive consolidation and exchange of land. Such works must be carried out first in villages where they are most urgent.

Description of identified factors

For the purposes of creating the ranking of urgency of the consolidation and exchange of land in the gmina of Poświętne, 76 factors characterizing respective villages were identified. These factors were calculated based on data obtained from the register of land and buildings maintained by the Poviát Administration in Opoczno. Detailed analysis revealed that the 26 most significant factors characterizing each village were selected for further studies.

Preliminary analysis covered a general description of the distribution of values of respective variables presented in the form of descriptive statistics (Table 1). Each variable was determined as either an LTB (larger-the-better characteristic) or an STB (smaller-the-better characteristic) for the needs of the consolidation process. With regard to the ranking method, all characteristics were adopted as LTB. Six groups of factors were classified as LTB (Table 1). The first group is general information, including: x1 – total area, x2 – total number of plots, x3 – number of residents, x4 – number of residents per km², x5 – % of the area of land owned by individual farmers, x6 – % of the number of plots owned by individual farmers, x7 – average area of the plot owned by individual farmers. Another group comprises information referring to land owned by individual farmers, such as: x8 – number of registration units in subgroup 7.1, x9 – % of registration units in subgroup 7.1, x10 – number of plots of a registration unit in subgroup 7.1, x11 – area of the plots of a registration unit in subgroup 7.1, x12 – % of the number of plots in subgroup 7.1, in relation to group 7, x13 – % of the area of the plots in subgroup 7.1, in relation to group 7, x14 – average number of plots per registration unit, x15 – average area of a registration unit. Another group is the productivity ratio calculated for x16 – arable land and x17 – grassland. A further group is the structure of ownership, including: x18 – % of land owned by the Agricultural Property Agency of the State Treasury and x19 – land owned by gminas. One more group, i.e. plots without access to roads, includes: x20 – % of the number of plots without access to roads and x21 – % of the area of plots without access to roads. The STB characteristics were: x22 – fragmentation ratio, x23 – % share of orchards, x24 – % share of forests, x25 – average elongation ratio and x26 – synthetic ratio of plot elongation for the precinct.

Prior to preparing a synthetic ranking based on the output values of diagnostic characteristics, they are often subject to preliminary selection. The most popular criteria refer to not including variables with low level of variation in the analysis (it is often assumed that these are the characteristics for which the coefficient of variation (V) is lower than 20%). The criterion of the coefficient of variation is not satisfied by: % of the number of plots owned by individual farmers (V=7.0%), % of the number of plots in subgroup 7.1 in relation to group 7 (V=13.0%), % of the area of plots in subgroup 7.1 in relation to group 7 (V=6.5%), arable land productivity ratio (V=18.1%), grassland productivity ratio (V=14.7%) and fragmentation ratio (V=10.0%). Due to their substantive value, these characteristics were retained for the purposes of objective analysis. For other variables the coefficient of variation exceeds 20%.

The method of creating the ranking of urgency of consolidation and exchange of land

The use of statistical methods in scientific research has been broadly discussed by (JASIŃSKA, PREWEDA, 2013). In the process of standardizing the original values of diagnostic characteristics (x) they must be converted according to the selected standardization method into variables (Z) without designations and with a fixed, uniform dispersion range. One of the methods standardizing quantitative characteristics is the zero unitarization method (BORKOWSKI, KUKUŁA, 2012).

Table 1. Factors selected for analysis.

Selected factors	LTB/ STB	Average	Me	min	max	V
x ₁ – total area	↑	828.2	616.3	227.9	3313.2	89.3
x ₂ – total number of plots	↑	926.9	866.0	317.0	2097.0	49.7
x ₃ – number of residents	↑	210.7	170.0	32.0	602.0	73.8
x ₄ – number of residents per km ²	↑	32.7	23.3	8.4	142.2	96.1
x ₅ – % of the area of land owned by individual farmers	↑	69.5	83.3	26.5	96.4	38.7
x ₆ – % of the number of plots owned by individual farmers	↑	88.2	90.0	74.5	95.3	7.0
x ₇ – average area of plots owned by individual farmers	↑	0.6	0.6	0.3	1.5	48.6
x ₈ – number of registration units in subgroup 7.1	↑	124.2	116.0	34.0	260.0	52.6
x ₉ – % of registration units in subgroup 7.1	↑	62.1	67.5	19.5	85.2	29.2
x ₁₀ – number of registration units in subgroup 7.1	↑	718.6	624.0	187.0	1849.0	59.4
x ₁₁ – area of plots per registration unit in subgroup 7.1	↑	424.9	388.6	178.6	1125.7	56.0
x ₁₂ – % of the number of plots in subgroup 7.1 in relation to group 7	↑	85.4	89.4	58.3	96.6	13.0
x ₁₃ – % of the area of plots in subgroup 7.1 in relation to group 7	↑	93.2	95.2	76.5	98.9	6.5
x ₁₄ – average number of plots per registration unit	↑	6.3	5.4	2.6	14.9	52.0
x ₁₅ – average area of a registration unit	↑	3.7	3.3	1.6	8.3	43.9
x ₁₆ – arable land	↑	28.5	25.2	22.8	37.5	18.1
x ₁₇ – grassland	↑	34.8	35.7	24.2	45.5	14.7
x ₁₈ – % of land owned by the Agricultural Property Agency of the State Treasury	↑	0.0	0.0	0.0	0.1	184.1
x ₁₉ – % of land owned by the gminas	↑	1.7	1.7	0.3	4.3	58.7
x ₂₀ – % of the number of plots without access to roads	↑	16.3	14.3	2.7	37.0	60.0
x ₂₁ – % of the area of plots without access to roads	↑	16.6	13.9	4.1	44.8	69.5
x ₂₂ – fragmentation ratio	↓	4.1	4.1	3.3	4.8	10.0
x ₂₃ – % of orchards	↓	0.4	0.2	0.0	1.5	132.3
x ₂₄ – % of forests	↓	48.1	50.7	13.0	77.1	45.6
x ₂₅ – average elongation ratio	↓	2.4	2.4	1.1	4.1	32.7
x ₂₆ – synthetic ratio of plot elongation for the precinct	↓	2.6	2.8	1.5	3.7	30.8

Source: Own study.

This method allows standardizing diagnostic variables by testing the range of the characteristic (JĘDRZEJCZYK, et al. 2002).

LTB and STB diagnostic variables are calculated by means of unitarization according to the following formulas:

- 1) LTB – variables whose increased value improves the evaluation of a characteristic of the analyzed object; then, standardized variables are calculated according to the formula:

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

- 2) STB – variables whose increased value deteriorates the evaluation of a characteristic of the analyzed object; then, standardized variables are calculated according to the formula:

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

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.

In order to obtain a synthetic measure means values are calculated for sets describing the respective characteristics (PLUTA 1986) according to the following formula:

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

Standardized measures fall within the range <0;1>. The results can be interpreted as an average of optimum values achieved by each of the objects. Thus, the higher the synthetic measure, the higher position of the object in the ranking being created (KRÓL, LEŃ, 2016).

Results

Specific analyses showed that the impact of single factors on the ranking position of respective villages was much differentiated. The results of tests indicate (chart 1) that the largest need for consolidation and exchange of land was recorded in the village of Brudzewice, which was ranked first in that respect in all 27 rankings. It is followed by Kolonia Gapinin, ranked second in nearly all rankings except the one excluding x8 – number of registration units in subgroup 7.1. This village has as many as 260 registration units in subgroup 7.1, which is the highest number in the entire gmina.

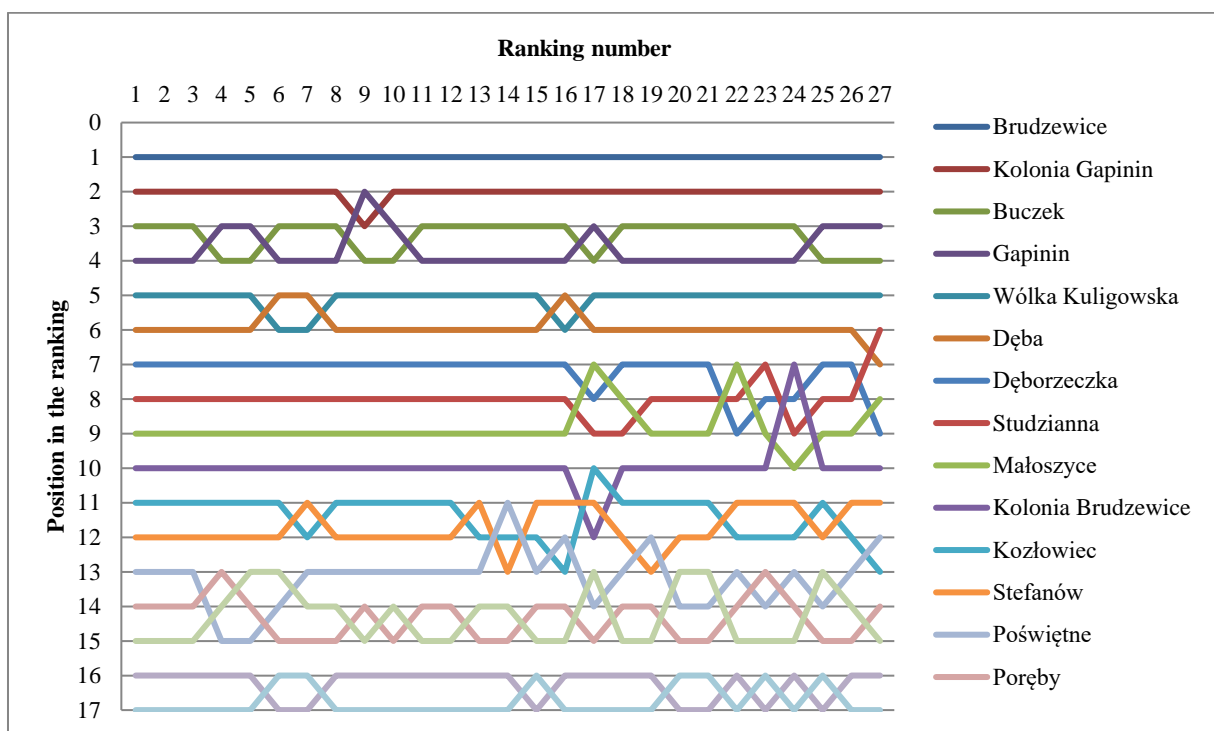


Fig 1. Chart presenting position changes in 27 rankings for respective villages in the gmina of Poświętne.
Source: Own study.

Other villages which require comprehensive redesigning of their spatial structure are Buczek and Gapinin. Their ranking position changes depending on the following factors: x3 – number of residents, x4 – number of residents per km², x8 – number of registration units in subgroup 7.1, x9 – % of registration units in subgroup 7.1, x16 – arable land productivity ratio, x24 – % share of forests, x25 – average elongation ratio and x26 – synthetic ratio of plot elongation for the precinct. The village of Buczek is ranked third in all rankings apart from the above-mentioned ones, in which it is fourth, which testifies to a high percentage of residents, a high number of registration units in subgroup 7.1, a high arable land productivity ratio, small forest cover and large elongation of plots in the village. Gapinin comes fourth in all the rankings apart from the above-mentioned ones, in which it is third. The exception is the ranking excluding x8 – number of registration units in subgroup 7.1, where this village is ranked second. This is evidence of a low percentage of residents, low number of registration units in subgroup 7.1, low arable land productivity ratio, large forest cover and small elongation of plots in the village. The village of Wólka Kuligowska normally ranks fifth in most rankings, except those excluding: x5 – % of the area of land owned by individual farmers, x6 – % of the number of plots owned by individual farmers and x15 – average area of a registration unit, in which it is ranked sixth, which testifies to a high number of plots and area of individual farms in that village and a

high average area of the registration unit, being the largest in the gmina of Poświętne and amounting to 8.30 ha. In turn, the village of Anielin occupies the last, seventeenth place in most rankings, except those excluding: x5 – % of the area of land owned by individual farmers, x6 – % of the number of plots owned by individual farmers, x14 – average number of plots per registration unit, x19 – land owned by the gminas, x20 – % of the number of plots without access to roads, x22 – fragmentation ratio and x24 – % share of forests. This village ranks sixteenth, which is evidence of a small number and area of plots owned by individual farmers, a low average number of plots per registration unit, a small area of plots owned by the gminas, a small number of plots without access to roads, small fragmentation of plots and large forest cover. This village is characterized by the lowest need for consolidation and exchange of land.

Table 2 presents the ranking of urgency of undertaking land consolidation works with regard to the average value of the synthetic measure for all tests performed.

The performed studies indicate that land consolidation works should be undertaken most urgently in Brudzewice, followed by Kolonia Gapinin, Buczek and Gapinin.

Table 2. Ranking of urgency of undertaking land consolidation works based on the average from 27 rankings.

Ranking position	Average synthetic measure	Village
1	0.611	Brudzewice
2	0.553	Kolonia Gapinin
3	0.535	Buczek
4	0.528	Gapinin
5	0.486	Wólka Kuligowska
6	0.462	Dęba
7	0.447	Dęborzeczka
8	0.435	Studzianna
9	0.424	Małoszyce
10	0.413	Kolonia Brudzewice
11	0.39	Kozłowiec
12	0.386	Stefanów
13	0.366	Poświętne
14	0.346	Poręby
15	0.346	Mysiakowiec
16	0.285	Ponikła
17	0.271	Anielin

Source: Own study.

Conclusions

Land consolidation is one of the fundamental rural management works contributing to comprehensive improvement in the organisation of agricultural production space. It aims to transform the surface arrangement of fragmented land, land in a plot patchwork and excessively elongated plots into larger and regular plots. The necessity for land consolidation is determined by detailed analyses of parameters testifying to the requirement for consolidation works. It is estimated that in Poland such defective agricultural space structures cover an area of 3 million ha. Hence, despite EU grants, larger areas cannot be covered by such works for reasons related to finance or human resources. For the purposes of reasonable financial management and undertaking land consolidation and exchange, it is necessary to establish the urgency of undertaking consolidation and exchange of land. In the gmina of Poświętne, the villages which in the first place require comprehensive redesigning of the spatial structure are: Brudzewice, Kolonia Gapinin, Buczek and Gapinin. In those villages private farmland has a predominant share and cropland is predominant in the structure of use. The spatial structure of this land is defective and is characterized by very unfavourable geometry of plots. The results testify to the need for redesigning the existing arrangement of plots, which should contribute to improving the basic land configuration parameters and creating more favourable conditions for land development in this area. The analysis of the network of roads revealed a high number of plots without access to roads in the described villages. The occurrence of areas not connected to the road network is a significant characteristic affecting rational and profitable agricultural production.

The acquisition of such data enables rational programming of the urgency of land consolidation in the gmina or powiat. It clearly identifies rural areas characterized by the most unfavourable spatial structure. Reconstruction of the agrarian structure of rural areas is necessary to ensure permanent and

sustainable development of such areas. Land consolidation, as a space management tool, leads to desirable structural changes but it must be carried out systematically and it must become an element of the long-term policy of regional governments with respect to the development of rural areas.

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