ANALYSIS OF DEMAND FOR LAND CONSOLIDATION IN MILEJÓW COMMUNE, ŁĘCZNA DISTRICT

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Abstract. The spatial structure of land in south-eastern Poland is characterized by a high fragmentation, small farms and a road network that is not adjusted to the requirements of modern, mechanized agricultural production. The patchwork pattern of land ownership is one of the main factors that negatively affect agricultural production. Fields located in an external patchwork can be fully used for agricultural production, but the production costs are higher, and the income from the farm is smaller. The spatial layout of privately owned land in the countryside has undergone continuous changes over the centuries, which have led to fragmentation and scattering of plots, a lack of road access and large distances from the homestead. The aim of this study was to analyse the need for land consolidation in the commune of Milejów in Łęczna District. The commune is situated in the borderland between the Lublin Upland and Polesie Lubelskie. It is located about 35 km to the east of Lublin, in Łęczna District. It occupies an area of 115.2 km^2 and is one of the 213 communes of the Lublin Province. There are 24 villages in the commune, of which the largest are Milejów Osada and Jaszczów. The focus of the study was an analysis of the fragmentation of plots belonging to individual owners, land layout, and scattering of cadastral plots in selected villages. The size of the patchwork of land in terms of land area, number of owners and number of plots in the commune under study was relatively large. Individual owners were found to own 97 23.7702 ha of land divided into 20 037 cadastral plots. The average land area in the studied commune was 0.49 ha. The analysis showed differences among the particular villages in the commune of Milejów. The main problems in the analysed area were large land fragmentation and a strip-type plot patchwork. The only rational program for restructuring the existing system of land ownership and elimination of excessive fragmentation is land consolidation.

Keywords: land consolidation, patchwork of land, land spatial structure.

Introduction

Rural areas in southern, south-eastern and part of central Poland are characterized by an unfavourable spatial structure, a high fragmentation of plots, a disadvantageous distribution of farmland and large distances from plots to the homestead [1-5]. Often, fragmentation of farms depends on their size. The index of the number of plots per average farm area is, relatively, too high. Rural areas are all non-urban areas of the country with the exception of industrial areas outside city limits [6].

Another negative aspect related to excessive fragmentation of farms is the patchwork pattern of land ownership. This is another factor which negatively affects agricultural production and hence the work and life of a farmer. A patchwork can be defined as scattering of plots belonging to one land-holding among plots belonging to other holdings. Land in a patchwork may be located either in the village where the owner resides, and then we speak of an in-village patchwork, or it can be located outside the village in which the owner lives and then we speak of an inter-village patchwork, commonly referred to as an external patchwork [7].

A technical intervention which eliminates the defective distribution of land and creates better conditions for accelerating the development of agricultural production is consolidation and exchange of land. Consolidation programs so far have paid more attention to the elimination of internal patchworks of land ownership. External patchworks are corrected in part by bringing fields closer to the boundaries of the village in which their owners live. Land consolidation could positively influence on spatial order in communes with taking into account development of investment areas [8].

Owners who possess land in an external patchwork of fields can be divided into local non-resident owners and out-of-village non-resident owners. Because these two groups of owners have different characteristics, the term local non-resident owners will henceforth be used to refer to owners who have farmland outside the village being studied which is their place of residence. The term out-of village non-resident owners, on the other hand, will be used to speak of owners who have land in the village under study but live in other localities [2; 7; 9].

Interventions aimed at improving the agricultural production space cannot be carried out simultaneously in all villages due to economic, technical and social conditions. Therefore, efforts towards transforming defective land structure should be made in the first place in those villages which most urgently require such transformation.

The aim of this study was to analyse the need for land consolidation in the commune of Milejów in Łęczna District. The article presents a detailed study of the spatial layout of privately-owned land in three villages of the commune of Milejów, located in Łęczyński District, Lublin (Fig. 1). The subject of the study is the fragmentation of plots of individual owners, land layout, and scattering of cadastral plots.
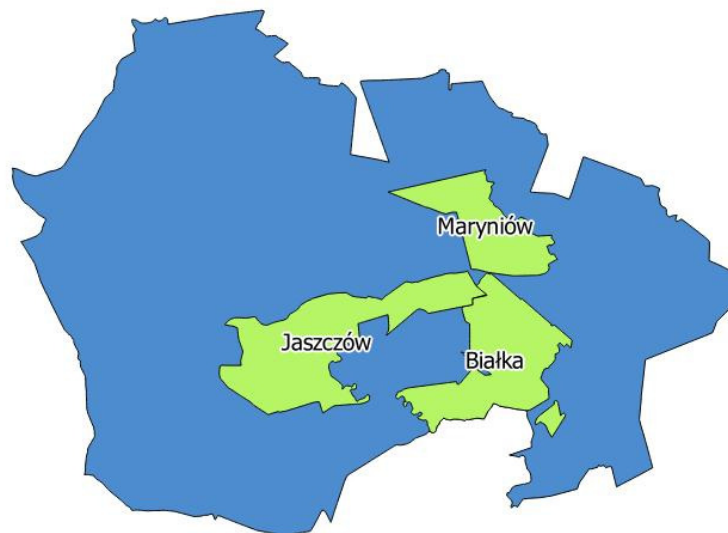

Fig. 1. **Spatial distribution of the surveyed villages in the commune of Milejów**

Lublin Province is, in statistical terms, the least developed region of Poland, a country with a relatively low level of development, the dynamics of which, however, are high (compared with other European countries). These high dynamics of development are the effect of efficiently conducted structural and institutional reforms at the beginning of transformation from communism to capitalism, the consistent implementation of the objectives of these reforms for two decades now, and the many benefits arising from the Polish accession to the European Union [10]. The commune of Milejów is located in the central part of the Lublin Province. It is a medium-sized commune of an agricultural character. Most of its residents run family farms and earn their living by selling farming products. Individual owners in the village under study own 20,037 plots occupying an area of 9,723.7702 hectares. The mean surface area of a plot in the commune is 0.49 ha. Milejów is simultaneously the most populated and the most fragmented commune in the province.

Materials and methods

Studies were carried out in the villages of Białka, Jaszczów, and Maryniów. The analyses were performed using descriptive and spatial data from the database of the Register of Land and Buildings in Milejów. A cartographic-descriptive method was used. The fragmentation index was calculated for each village, which allowed us to develop a prioritization scheme for land consolidation. The land fragmentation index for each village was calculated on the basis of the formula created by Leń and Noga [11]. The authors did study about the number and surface area of plots in different size ranges accepted respectively.

As the analyses conducted in selected villages of the commune of Milejów show, natural persons (individuals) have the largest share in the structure of land ownership there. The area occupied by privately-owned land holdings in the village of Maryniów is 341.4267 ha, which constitutes 94.1 % of the total area of the village; in Jaszczów 641.6674 ha of individually-owned farmland represents 87.4 % of the total village area and in Białka individuals own 513.2824 ha of farmland, i.e. 85.5 % of the total area of the village. Group 1 and 2 State Treasury Land represents 10.2 % (61.0988 ha) of farmland in Białka, 6.6 % (48.4795 ha) in Jaszczów and only 4.0 % (14.5800 ha) in Maryniów. This is

mainly land belonging to the Agricultural Property Agency of the State Treasury. The remaining land register groups occupy a small area in the analysed villages.

Table 1

Land ownership structure in selected villages of the commune of Milejów

Group no.	Name of land register group	Name of village					
		Białka		Jaszczów		Maryniów	
		Surface area	%	Surface area	%	Surface area	%
1	State Treasury Land excluding land leased out for perpetual usufruct	54.0588	9.01	48.1295	6.56	14.5800	4.02
2	State Treasury Land including land leased out for perpetual usufruct	7.0400	1.17	0.3500	0.05	-	-
4	Land belonging to communes and associations of communes excluding land leased out for perpetual usufruct	20.7644	3.46	13.3035	1.81	4.3300	1.19
7	Land belonging to natural persons (individuals)	513.2824	85.52	641.6674	87.42	341.4267	94.14
8	Cooperative-owned land	0.1800	0.03	-	-	-	-
9	Land belonging to churches and religious associations	0.4000	0.07	0.1600	0.02	-	-
10	Land belonging to land communities	-	-	16.9500	2.31	-	-
11	Land belonging to counties excluding land leased out for perpetual usufruct	4.4700	0.74	7.6439	1.04	2.3300	0.64
13	Land belonging to voivodeships excluding land leased out for perpetual usufruct	-	-	4.3373	0.59	-	-
15	Land belonging to other entities of record	-	-	1.4560	0.20	-	-
	Total village area	600.1956	100.00	733.9976	100.00	362.6667	100.00

Source: data obtained from the Register of Land and Buildings.

Land use is the use of land in accordance with its designation. The total area of a holding includes all land belonging to the holding, i.e. all land used for agricultural purposes (arable land, orchards, meadows and pastures) and land used for non-agricultural purposes such as forests, yards, land under buildings or land designated for construction, decorative gardens etc. A land use unit is a continuous stretch of land utilized in a uniform manner. For the purposes of the land register currently in force, eight groups of land use units characterized in terms of the type of the land cover and land use were distinguished.

As it follows from the analysis of the structure of land use (Table 2) in the villages of the commune of Milejów, these localities constitute a typically agricultural area. The dominant land register group is agricultural land (Jaszczów, 77.79 %; Białka 60.82 % and Maryniów 57.80 %), the largest share of which is arable land (44.70 %, 36.05 %, and 47 81 %, respectively) and the smallest – land under ponds, which is found only in the village of Jaszczów. Another sizeable group are woodlands, which occupy the largest area in the village of Maryniów 40.05 % (Białka 34.35 %, Jaszczów 17.08 %). This group consists of forests and wooded and bush-covered land. The total share of built-up areas and urbanized areas is 4.70 % in the village of Białka, 3.73 % in Jaszczów and 2.14 % in Maryniów. Land under flowing surface waters is found only in Jaszczów (1.40 %) and Białka (0.13 %). No organic-farming land was recorded in any of the villages surveyed.

Table 2

Land use structure in selected villages of the commune of Milejów

No.	Type of land use unit	Name of village					
		Białka		Jaszczów		Maryniów	
		Surface area, ha	%	Surface area, ha	%	Surface area, ha	%
1	Arable land	216.3876	36.05	328.1224	44.70	173.3968	47.81
2	Orchards	1.3300	0.22	12.0489	1.64	2.2000	0.61
3	Permanent meadows	112.6901	18.78	153.5015	20.91	13.6607	3.77
4	Permanent pastures	6.3648	1.06	5.7381	0.78	4.6594	1.28
5	Built-up agricultural land	19.3365	3.22	42.0257	5.73	12.3587	3.41
6	Land under ponds	-	-	0.3716	0.05	-	-
7	Land under ditches	1.2886	0.21	7.2753	0.99	1.7100	0.47
8	Wasteland	7.6479	1.27	21.8570	2.98	1.6500	0.45
Total agricultural land area		**365.0455**	**60.82**	**570.9405**	**77.79**	**209.6356**	**57.80**
9	Forests	146.1600	24.35	114.0068	15.53	136.4091	37.61
10	Wooded and bush-covered land	60.0000	10.00	11.3879	1.55	8.8447	2.44
Total woodland area		**206.1600**	**34.35**	**125.3947**	**17.08**	**145.2538**	**40.05**
11	Residential areas	0.3077	0.05	1.8949	0.26	0.1073	0.03
12	Industrial areas	0.0000	0.00	0.1365	0.02	0.0000	0.00
13	Other built-up areas	1.6475	0.27	4.0353	0.55	0.5700	0.16
14	Recreational areas	-	-	0.7169	0.10	-	-
15	Public rights of way	26.2249	4.37	20.5888	2.81	7.1	1.96
Total built-up and urbanized areas		**28.1801**	**4.70**	**27.3724**	**3.73**	**7.7773**	**2.14**
16	Land under flowing surface waters	0.81	0.13	10.2900	1.40	-	-
Total area of the village		**600.1956**	**100.00**	**733.9976**	**100.00**	**362.6667**	**100.00**

Source: data obtained from the Register of Land and Buildings.

The analysis of fragmentation of land in the surveyed villages concerned only parcels belonging to individual owners. Studies were carried out in 8 size ranges, because the average plot size does not reflect the actual fragmentation in the different villages. This is because the villages under study have a ribbon layout of plots. The fragmentation structure of plots belonging to individual owners is illustrated by the data in Table 3. According to the data presented in this table, the largest number of plots in the size range of 0.11-0.30 ha are found in the villages of Białka (40.19 %) and Jaszczów (31.37 %), while in the village of Maryniów most plots are in the size range of 0.31-0.60 ha (25.04 %). As it is clear from the study, the percentage of plots in the different size ranges is different for each of the investigated villages.

A characteristic feature of Polish agriculture, which necessitates land consolidation interventions is excessive fragmentation of land, i.e. distribution of land over many small-area contours or small cadastral plots. This is one of the major factors hampering profitable agricultural production and one of the reasons for implementing a consolidation program in a given area, which can help improve the parameters of the spatial structure of agricultural land. The area of a plot determines how much labour input it requires. In countries of the European Union, plot areas range from 0.8 to 10.00 ha [12]. The

present study of the land register data has shown that the largest percentage of plots in Białka and Jaszczów have areas in the range of 0.31 to 0.60 ha. In the village of Maryniów, the largest plot areas are in the range from 0.61 to 0.90 ha.

Table 3

Number of plots in different size (surface area) ranges

No.	Size range	Białka		Jaszczów		Maryniów	
		Number of plots	% share of plots	Number of plots	% share of plots	Number of plots	% share of plots
1	up to 0.10	568	30.12	290	20.54	123	18.11
2	0.11-0.30	758	40.19	443	31.37	164	24.15
3	0.31-0.60	351	18.61	380	26.91	170	25.04
4	0.61-0.90	136	7.21	127	8.99	116	17.08
5	0.91-1.20	32	1.70	71	5.03	66	9.72
6	1.21-1.50	14	0.74	24	1.70	18	2.65
7	1.51-1.80	12	0.64	22	1.56	4	0.59
8	over 1.81	15	0.80	55	3.90	18	2.65
	Total	1886	100	1412	100	679	100

Source: data obtained from the Register of Land and Buildings.

Agriculture in the commune of Milejów is fragmented and inefficient. In total, there are only 2,160 agricultural holdings here, of which 94 % have an area of 1 to 10 ha. Only 27 farms have an area of over 20 hectares. The average acreage of a farm in the commune is 3.6 hectares, which is lower than the average for the province (6.9 ha) [13].

Table 4

Area of plots belonging to individual farm-holdings

No.	Size range	Białka		Jaszczów		Maryniów	
		Surface area of plots	%	Surface area of plots	%	Surface area of plots	%
1	up to 0.10	34.1038	6.43	17.63	2.63	6.28	1.79
2	0.11-0.30	141.3923	26.64	88.2596	13.17	32.3489	9.23
3	0.31-0.60	155.3351	29.27	169.1555	25.25	76.5876	21.86
4	0.61-0.90	94.7800	17.86	93.6270	13.97	89.4572	25.54
5	0.91-1.20	32.7000	6.16	74.2934	11.09	69.1651	19.74
6	1.21-1.50	18.6100	3.51	34.0707	5.09	24.0212	6.86
7	1.51-1.80	19.9900	3.77	36.6529	5.47	6.8994	1.97
8	over 1.81	33.8600	6.38	156.2817	23.33	45.5673	13.01
	Total	530.7712	100	669.9708	100	350.3267	100

Source: data obtained from the Register of Land and Buildings.

Results and discussion

The studies of the land register data showed that land holdings belonging to individual owners in the investigated villages are highly fragmented with considerable scattering of cadastral plots. Currently, steps should be taken to eliminate the faulty structure of land ownership and this way to ameliorate agricultural production and boost its development as well as improve the living and working conditions of farmers. One possible solution to this problem is consolidation and exchange of land. However, interventions aimed at improving the agricultural production space cannot be carried out simultaneously in all villages due to economic, technical and social conditions. Therefore, efforts towards transforming defective land structure should be made in the first place in those villages, which

most urgently require such transformation [2]. To find out, which of the villages studied needed consolidation most, we used the land fragmentation index calculated in accordance with the formula developed by Leń and Noga [11].

$$W_r = \frac{\sum_1^n (x_n * l_n)}{P},$$ (1)

where X_n – surface area of cadastral plots in the adopted area-ranges;
l_n – weight of each of the eight area groups 1-8;
P – total area of individual land holdings in the village.

Calculations were done for eight size ranges, because the average plot size does not reflect the actual fragmentation in the different villages. Size ranges were adopted as follows:

1 – up to 0.10 ha, 2 – 0.11-0.20 ha, 3 – 0.31-0.60 ha, 4 – 0.61-0.90 ha, 5 – 0.91-1.20 ha, 6 – 1.21-1.50, 7 – 1.51-1.80 ha, 8 – over 1.81 ha

The adoption of 8 different size ranges was a result of the orderly number of plots in the villages as the surface was growing. This is because the different villages have different land layouts. Each of the adopted ranges has a weight that is from 1 for the first group, then up to 8 for the area group over 1,81 ha. The adopted weights allowed for the calculation of the synthetic land fragmentation index for villages. The land fragmentation index made it possible to classify the investigated villages to appropriate type-classes allowing us to establish an appropriate order of consolidation interventions. The village types were separated according to the research by Leń and Noga [11] up to 3.25 type I, 3.26-4.25 type II, 4.26-5.25 type III and over 5.26 type IV. The land fragmentation index for the village of Białka was 3.48, which was classified as a type II village, and the indicators for Jaszczów (4.71) and Maryniów (4.46) classified these villages as type III villages.

The above categorization is intended to distinguish villages with similar spatial structure and to determine the degree of differentiation occurring in the commune and thus to determine the need for comprehensive work of exchange and land consolidation.

Conclusions

Analyses of the urgency of land consolidation and exchange, especially the comparative spatial analyses, can be facilitated by applying the methods of multivariate statistics, which allow the determination of a synthetic measure. Studies of this type have been carried out by Leń and Król [3, 4]. They confirmed the validity of using statistical methods for prioritization of land consolidation and exchange interventions. In the present study, however, we used a different method involving the analysis of the spatial structure of three selected villages of the commune of Milejów and calculation of their land fragmentation indexes, which allowed us to determine in what order land consolidation programs for those villages should be implemented. The analysis of land register data leads to the following observations and conclusions:

1. The fragmentation of land in the villages under study points to a very defective spatial structure of those localities. The dominant plot sizes are those ranging from 0.11 ha to 0.30 ha and from 0.31 ha to 0.60 ha. This type of spatial structure of farmland is characteristic of south-eastern Poland.
2. Such unfavourable fragmentation is a consequence of inheritance, land turnover and arranged marriages.
3. The only rational solution to improve the working and living conditions of farmers is implementation of comprehensive land consolidation and exchange programs. This process could eliminate excessive fragmentation and scattering of plots as well as bring fields closer to the homestead.
4. The land fragmentation indexes calculated in this study show that Białka, classified as Type II village, should be consolidated before Jaszczów and Maryniów, qualified as Type III villages, in which land consolidation interventions should be performed simultaneously. In all the villages with plot-size-ranges equal to or larger than 0.11-0.30 ha, the percentage share of the number of plots was observed to decline with increasing the size range.

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