

PRINCIPLES OF LAND VALUE ESTIMATION IN CONSOLIDATION PROCEEDINGS IN POLAND

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Summary

The subject of the study was the principles of land estimation used for the purpose of consolidation proceedings, as they are applied in Poland.

The work examines the legal conditions relating to the estimation of land for the purposes of consolidation. Documents prepared in the years 2005–2017 concerning land estimation (resolutions of the consolidation participants, and protocols from the value estimates) have been collected for 41 consolidated sites, located in 28 districts of 11 voivodships (regions). A survey was conducted among the surveyors-designers of the consolidation proceedings, consisting of 19 questions. In the current year, the co-author of the present article was present at meetings of consolidation proceedings' participants, convened in order to determine the rules for estimating land value on two sites located in different regions, and the material she collected during those meetings was used in the article.

The collected data were subjected to an analysis, which showed that within Poland there is no homogeneity in the method of estimating land value for the purpose of consolidation proceedings, and that the method used to determine the value of land, taking into account the 1-hectare estimated rate, and the price of 1dt of rye grain, according to the provisions of the agricultural tax, is incompatible with the principles for the valuation of agricultural real estate, as specified in the law on real estate management.

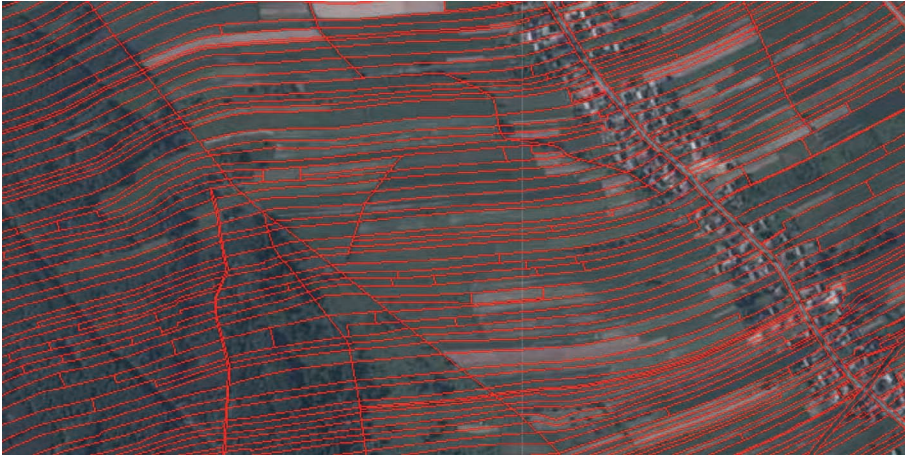
Keywords

agricultural land consolidation • land estimation • estimated 1-hectare rates

1. Introduction

Land consolidation is an instrument for transforming rural areas with an unfavourable land structure where the farms are small, where the plots are fragmented and scattered, and some of them have no access to public roads at all (Figure 1). The purpose of such action is to create more favourable conditions for farming and management in agriculture and forestry, by: improving the land structure of agricultural holdings, forests and forest land; introducing a more rational shaping of land plots; adjusting property boundaries to the system of water melioration facilities, roads and landforms. Consolidation work is regulated by the Law of 26 March 1982 on land consolidation

and land exchange [Ustawa... 1982]. Consolidation proceedings may be initiated at the request of most of the owners of agricultural holdings located in the area proposed for consolidation, or at the request of the owner of lands whose total area exceeds half of the area of the proposed consolidation.



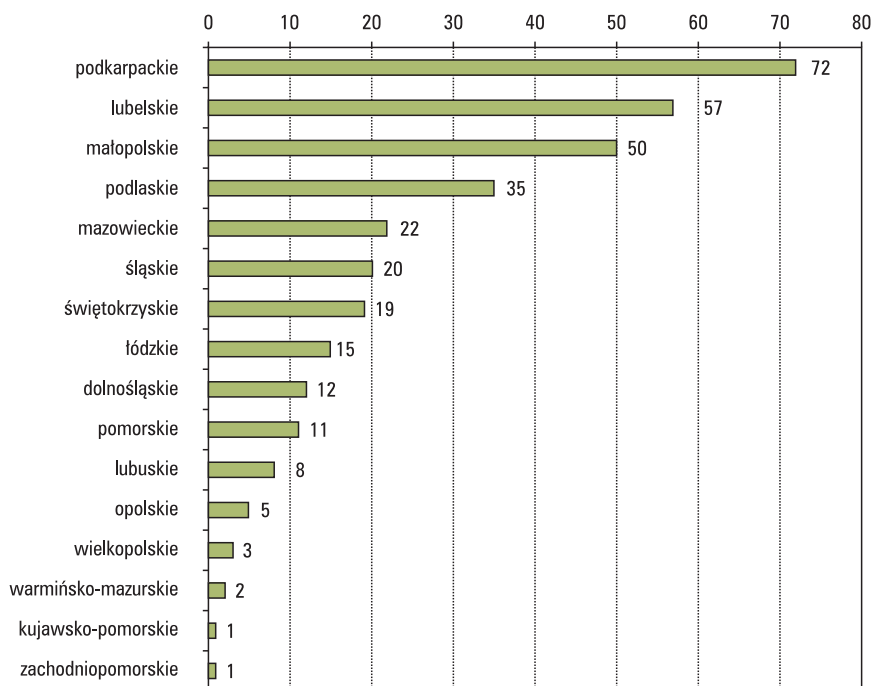
Source: Geoportal2

Fig. 1. Part of the Golezów area in Mielec municipality, Podkarpackie region

According to reports by the Ministry of Agriculture and Rural Development (MRiRW), in the years 2005–2015, 333 land consolidations took place throughout Poland (Figure 2). More than 64% of these were in the regions of: Podkarpackie, Lubelskie, Małopolskie and Podlaskie. The scope of the consolidation was very diverse, for example in the Podkarpackie region in 2012, in the county authority in Sanok completed proceedings for 2 participants and 0.15 hectares of land, while in the county authority in Jarosław, the consolidation proceedings concerned 1547 participants and 1492 ha.

As a result of the land consolidation procedure, each participant in the consolidation proceedings¹ receives plots within new limits. When allocating plots in the new conditions, the decisive factor is not the area size of the land, but its estimated value. According to this principle, the individual participants of the consolidation are allocated real estate, which is equivalent to the pre-consolidation land. Land evaluation is therefore one of the most important and most difficult elements of land consolidation proceedings [Czechowski 2015, Kluźniak 1932, Krzyżanowski 1928, Noga 1991, Ostrowski 1932, Sawicki 1933].

¹ Each proprietor at the time, independent owner, or user of the land subjected to the consolidation procedure, and in the case of the land owned by the State Treasury or a unit of the local government administration – also the entity managing the given land (for instance Agencja Nieruchomości Rolnych, Agricultural Property Agency), or an investor (for instance Generalna Dyrekcja Dróg Krajowych i Autostrad, General Directorate of National Routes and Motorways).

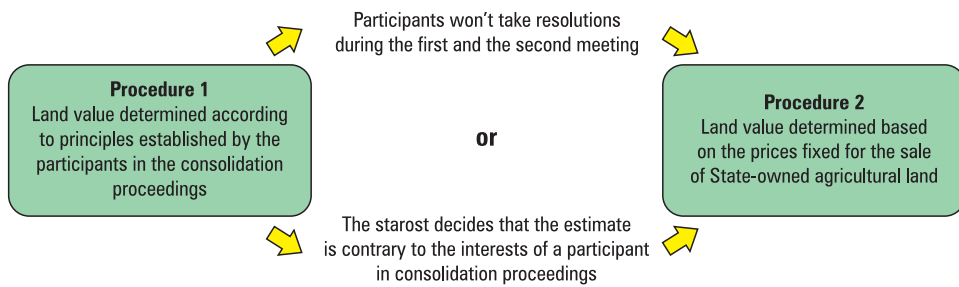


Source: own report based on the MRiRW data

Fig. 2. Number of completed consolidation proceedings between 2005–2015

2. Principles of land evaluation for the purpose of consolidation proceedings, in the understanding of the present legal regulation remaining in force

The only legal conditions for determining the principles of land estimation are contained in Art. 11 of the Law on land consolidation [Ustawa... 1982]. Estimated value of land may be determined in accordance with the principles set out in the resolution adopted by the participants in the consolidation proceedings. The resolution in question can be agreed upon during a meeting called by the starost (district governor). The resolution shall be adopted by a majority of three-fourths of votes, in the presence of at least half the number of participants in the consolidation procedure. In the event of failure to adopt the resolution during the meeting convened on the first appointed date, a resolution adopted by a majority of three quarters of the parties to the consolidation present at the meeting convened on the second adopted date (Article 13, section 2 [Ustawa... 1982]) is considered valid. Each participant in the consolidation procedure has one vote (Article 13, section 3 [Ustawa...1982]). Information on the appointed dates of meetings is communicated by the starost to the participants of the proceedings, by notice or in another publicly announced manner in the given locality (Article 31 [Ustawa... 1982]). Valuation procedure in respect to land is shown in Figure 3.

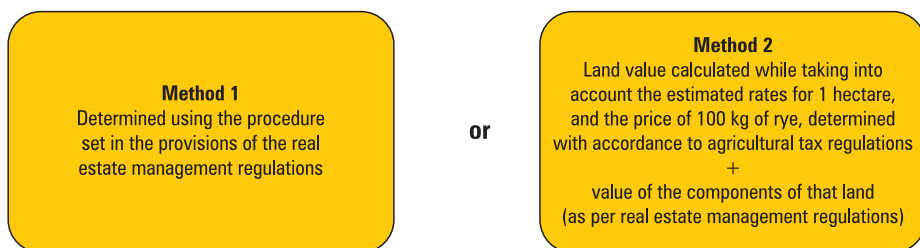


Source: authors' study

Fig. 3. Procedures for the determination of estimated land value for the purpose of consolidation proceedings

The second procedure of land valuation refers to the Law on the Management of Agricultural Property belonging to the State Treasury [Ustawa... 1991]. The valuation rules contained in this law apply to the valuation of agricultural land owned by the State Treasury at the disposal of the Agricultural Property Agency (ANR) or other land, where one of the parties to the transaction is the ANR acquiring real estate for State Treasury [Cymerman 2013] (Figure 3).

According to Article 30 of the aforementioned Law, property prices are set at an amount not lower than the values determined using the methods of fixing them in real estate management regulations or in the amount not less than the sum of the land value determined by the estimated one hectare rates and the price of 100 kg of rye, determined in accordance with the provisions on agricultural tax as well as the value of the components of that land, determined on the basis of regulations on real estate management (Figure 4).



Source: authors' study

Fig. 4. Methods for determining the prices of agricultural property belonging to State Treasury

The first method for determining the estimated value of land (Figure 4) is consistent with the principles of determining the value of land resulting from the law on real estate management [Ustawa... 1997]. On the other hand, the second method for determining

the estimated value of land before consolidation does not refer to the aforementioned principles; instead, it is a specific modification of the approach of the mixed method of estimation indices defined in § 18 and 19 of the Regulation by the Council of Ministers [Rozporządzenie... 2004]. From the aforementioned provision, it follows that this approach can be applied with respect only to agricultural and forest land in the absence of transactions involving such land. The value of land in this method is defined as the product of the estimation index of 1 ha of land and the price of 1 deci-ton² of rye grain adopted from the local market. The estimation index (Table 1) is determined based on the land class, according to data from the real estate cadastre and the tax district, adopted under the agricultural tax law.

This particular method, relative to the land used for agricultural purposes, takes into account the following factors: the location in respect to main roads, the quality of access roads, the risk of erosion, the difficulty of cultivation, the agricultural culture, the amount of environmental pollution, the structure of land use, the presence of drainage equipment, the presence of infrastructure impeding agrotechnology, which is determined in the form of price corrections, reducing the price per 1 dt of rye grain (v_1, v_2, \dots, v_9).

Table 1. Estimated indices in dt of rye grain yield from 1 ha according to the appendix to the [Rozporządzenie... 2004]

Tax district	Classes of arable land									Classes of meadows and permanent pastures						
	I	II	IIIa	IIIb	IVa	IVb	V	VI	VIz	I	II	III	IV	V	VI	VIz
I	145	132	118	100	80	60	35	15	8	145	118	93	67	35	13	5
II	126	115	103	86	70	52	30	12	5	126	103	80	58	30	10	3
III	110	100	90	75	60	45	25	10	1	110	90	70	50	25	8	1
IV	94	85	76	64	50	38	20	6	1	94	76	60	43	20	5	1

Land value estimated according to the aforementioned method is calculated using the following formula:

$$W_G = \left[\sum_{i=1}^n (N_{sz_{i,j}} \cdot P_i) \right] \cdot C_q \cdot (1 + v_1 + v_2 + \dots + v_9) \quad (1)$$

where:

- $N_{sz_{i,j}}$ – estimated rate according to Table 1,
- P_i – area in hectares of the i-class of soil quality,
- C_q – price per 1 dt of rye grain,
- v_i – corrections.

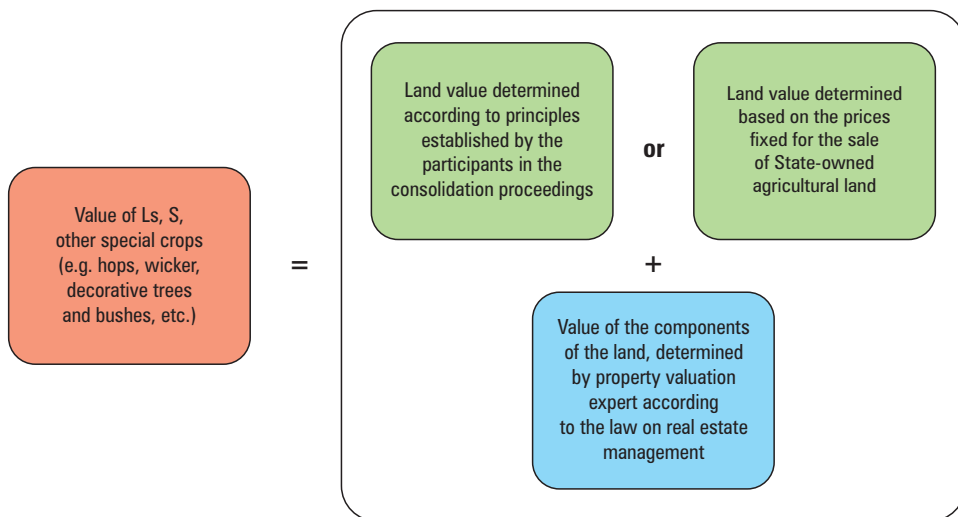
² 1 deci-ton (dt) = 0.1 tons (t) = 1 quintal (q) = 100 kilograms (kg)

The estimated value of agricultural land before the consolidation, determined according to the second method, is calculated using the following formula:

$$W_G = \left[\sum_{i=1}^n (N_{szi,j} \cdot P_i) \right] \cdot C_q \quad (2)$$

Estimated rates per one hectare (the second method) can be found in the Implementing Regulation for the Law on the Management of Agricultural Property belonging to the State Treasury – § 26 of the Regulation on the Detailed Procedure for the Sale of Agricultural Property Resource belonging to the State Treasury [Rozporządzenie... 2012]. The values of these rates are identical to those of the valuation regulation (Table 1). Prices per 100 kg of rye are based on systematic communications by the President of the Central Statistical Office on the average purchase price of rye, referred to in the Law on agricultural tax in Art. 6 section 2. Determination of value according to the second method (Figure 4) is performed solely on the basis of the updated registration data, which does not require the surveyor – designer of the consolidation – to possess professional qualifications of the property valuation expert.

The Law on land consolidation and land exchange [Ustawa... 1982] clarifies that, for forests and orchards, hop fields and other special crops, the estimated value is the estimated value of land determined according to one of the methods described above, plus the value of tree stands, trees and bushes, as well as other components of land, determined by a valuation expert in accordance with the rules specified in the regulations pertaining to real estate management regulations (Figure 5).



Source: authors' study

Fig. 5. Determination, for the purpose of consolidation proceedings, of the estimated value of forests, orchards, gardens, hop fields and other special crops

The legislators governed that the rules of the estimation are determined by the participants of the consolidation proceedings at the meeting called by the starost, but they did not indicate the procedure as to the participation of the said participants in this regard, nor did they set any limits to the formulation of these rules.

The co-author of the article has sent (via regional offices – Urząd Marszałkowski) an anonymous questionnaire consisting of 19 questions addressed to the surveyors-designers of the consolidation projects who, according to the law, perform the estimation of the land under the consolidation proceedings. 22 replies were received. Within the framework of the conducted research, also documentation of the estimation process was obtained (resolutions of participants in the consolidation proceedings on the principles of land estimation, and protocols from the conducted land evaluation), compiled in 2005–2017 for 41 consolidated objects located in 28 districts of 11 regions (Table 2 and Figure 6).

The analysis of the results of the survey and of the collected documentation, as well as the presence of the co-author at the meetings held to determine the principles of land estimation of two different consolidation proceedings (in Łódzkie and Podkarpackie regions), allows her to describe what that stage of consolidation proceedings looks like in practice, and what are the principles of land estimation applied in Poland.

The surveyor-designer of the consolidation proceedings is developing a draft of principles for land estimation – a draft resolution. Based on the general characteristics of the area subjected to consolidation proceedings – for example, environmental, soil and agricultural suitability, current use, investment, ownership – he analyses and distinguishes the surface elements to be assessed. When drafting the principles for estimation, the surveyor takes into account many factors such as:

- type of farms and directions of agricultural production,
- land use and management, soil quality, agricultural suitability, difficulty of cultivation (ranges of classification contours and land use from land registry maps, agromomic complexes from soil and agricultural maps)
- land use in the Local Spatial Development Plan (MPZP) or arrangements determined in the Study of Conditions and Directions of Spatial Development (SUiKZP) of the municipality,
- distance of fields from habitats (usually it is assumed that the buildings will not be moved).

Often at this stage, field inventory is carried out, in the field, of land use and development, the separation of field invariants (related to the occurrence of slopes and ditches, for example), which condition the course of estimation contours. The surveyor prepares an outline of the land estimate, using the opinion of the advisory committee, consulting on the issues of estimating contours and determining their value. In particular, this applies to:

- indication of areas of higher or lower suitability (e.g. water regime and wetlands, bushes and trees not shown on the land registry map, occurrence of power line

posts, wind turbines and easements, indication of areas with better farming culture or areas with special crops farming),

- indication of particularly attractive areas (potentially, for possible construction, or due to landscape or scenic values),
- proposed value of the individual estimation contours,
- land prices for possible surcharges used in the case of separating land with a different estimate than the value of land previously owned (Article 8 [Ustawa... 1982]).

In this way, a draft resolution on land valuation rules, and a working version of the land evaluation map are formed, which provide a starting point for the decision-making process by the participants in the consolidation proceedings. The developed draft proposal of the value estimate is presented to the participants in the consolidation proceedings present at the meeting called by the starost and subjected to discussion.

3. Methods of land value estimation illustrated with examples of selected consolidation objects in Poland

Below is a list of consolidation proceedings, from which the estimate documentation has been obtained (Table 2). It was divided according to the unit, in which the estimate rate of differentiated surface elements was expressed. In 15 districts (54%), the value of land was expressed in points (as units of estimation), in 4 districts (14%) in dt of rye grain, while in 9 districts (32%), it was expressed in currency. The location of the examined objects is shown in Figure 6.

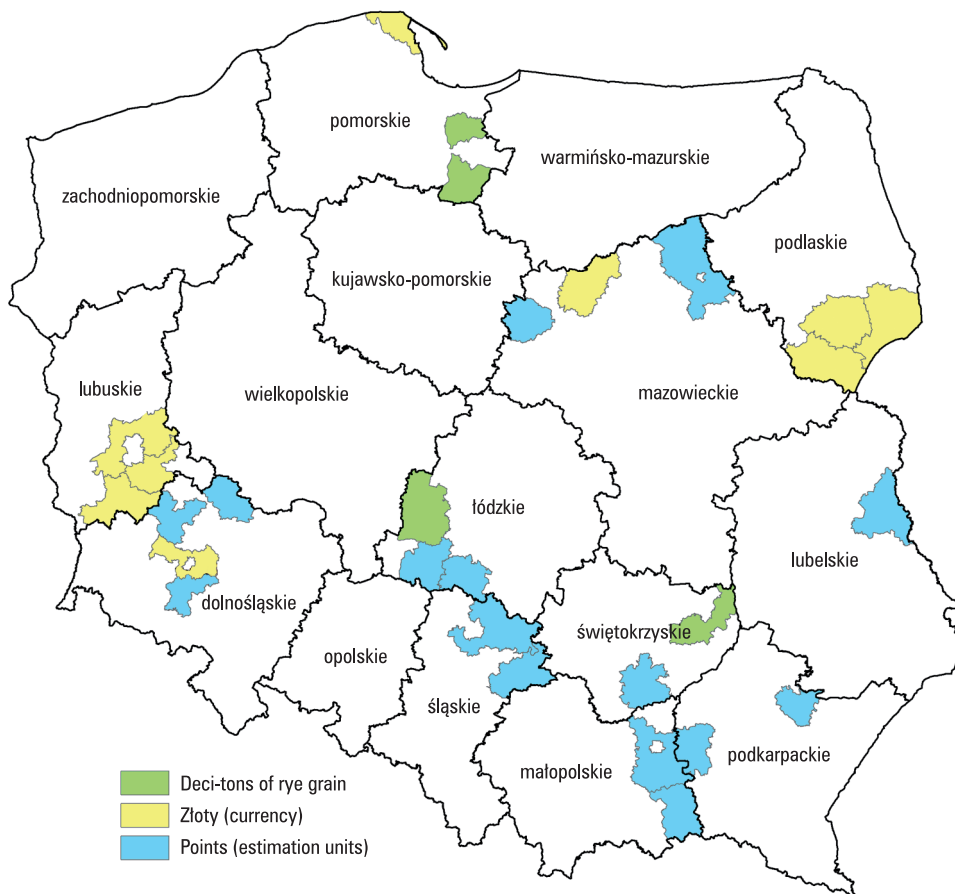
Table 2. List of objects from which the estimate documentation was obtained

No.	Region	District	Municipality	Object	Year ¹	Unit
1	dolnośląskie	Legnica	Krotoszyce	Krajów and part of Krotoszyce	2006	zł
2	dolnośląskie	Góra	Góra	Chrościna	2009	points
3	dolnośląskie	Góra	Góra	Witoszyce	2010	points
4	dolnośląskie	Jawor	Mściwojów	Mściwojów	2011	points
5	dolnośląskie	Polkowice	Chocianów	Szklary Dolne	2011	points
6	dolnośląskie	Góra	Wąsocz	Zbaków Dolny and Zbaków Górny	2013	points
7	łódzkie	Sieradz	Klonowa	Świątki and Kluźnica Błońska	2006	dt
8	łódzkie	Pajęczno	Działoszyn	Kapituła – Sęsów	2011	points
9	łódzkie	Wieluń	Wieluń	Sieniec	2011	points
10	łódzkie	Wieluń	Wieluń	Olewin – Sieniec	2017	points
11	lubelskie	Włodawa	Wyryki	Lipówka	2014	points
12	lubuskie	Żagań	Niegosławice	Przeclaw	2010	zł

13	lubuskie	Zielona Góra	Nowogród Bobrzański	Bogaczów	2012	zł
14	lubuskie	Nowa Sól	Bytom Odrzański	Tarnów Bycki	2013	zł
15	małopolskie	Gorlice	Sękowa	Męcina Wielka	2012	points
16	małopolskie	Tarnów	Tarnów	Tarnów city	2012	points
17	małopolskie	Tarnów	Lisia Góra	Zaczarnie	2014	points
18	małopolskie	Tarnów	Lisia Góra	Stare Żukowice	2014	points
19	mazowieckie	Ostrołęka	Czarnia	Brzozowy Kąt	2005	points
20	mazowieckie	Sierpc	Szczutowo	Grabal	2006	points
21	mazowieckie	Mława	Radzanów / Strzegowo	Marysinek and Rudowo / Budy Matusy	2008	zł
22	podkarpackie	Leżajsk	Leżajsk	Hucisko	2012	points
23	podkarpackie	Dębica	Dębica	Brzeźnica	2013	points
24	podlaskie	Siemiatycze	Drohiczyn Jaszczółty	Ostrożany and Smorczewo	2011	zł
25	podlaskie	Bielsk	Boćki	Andryjanki-Siekluki	2012	zł
26	podlaskie	Siemiatycze	Drohiczyn	Miłkowice	2012	zł
27	podlaskie	Siemiatycze	Drohiczyn	Miłkowice	2012	zł
28	podlaskie	Hajnów	Narewka	Olchówka	2013	zł
29	podlaskie	Siemiatycze	Grodzisk	Drochlin	2013	zł
30	pomorskie	Kwidzyń	Ryjewo	Mątownie Pastwiska	2006	dt
31	pomorskie	Puck	Krokowa	Żarnowiec and Wierzchucino	2006	zł
32	pomorskie	Kwidzyń	Ryjewo	Jarzębina	2010	dt
33	pomorskie	Kwidzyń	Ryjewo	Rudniki	2010	dt
34	pomorskie	Kwidzyń	Ryjewo	Barcice	2013	dt
35	pomorskie	Malbork	Stare Pole	Kławki	2013	dt
36	śląskie	Częstochowa	Lelów	Biała-Wielka	2013	points
37	śląskie	Zawiercie	Łazy	Chruszczobród	2013	points
38	śląskie	Zawiercie	Łazy	Chruszczobród-Piaski	2013	points
39	śląskie	Zawiercie	Łazy	Wiesiółka	2013	points
40	świętokrzyskie	Opatów	Ożarów	Dębno	2011	dt
41	świętokrzyskie	Busko-Zdrój	Solec-Zdrój	Kików	2013	points

¹ the year in which the documentation was prepared

Source: authors' study



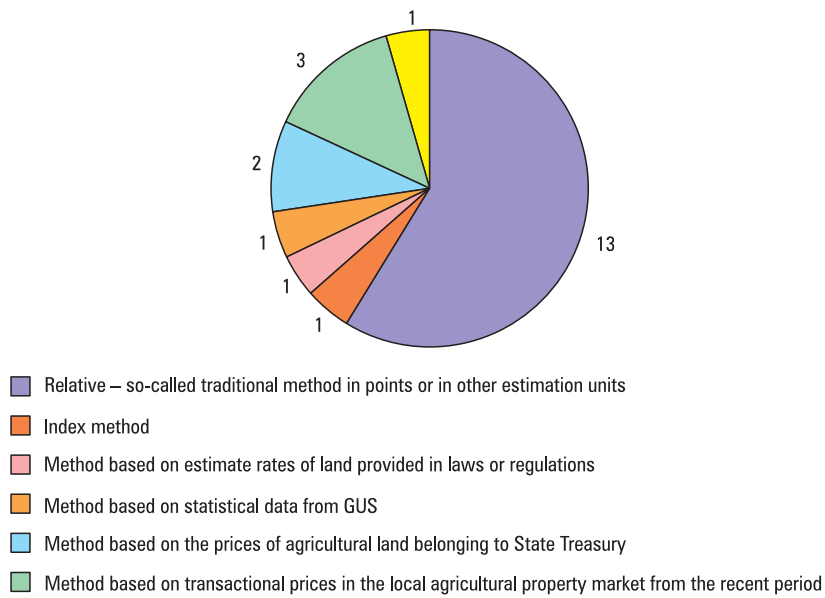
Source: authors' study

Fig. 6. Units used for the estimation of value of differentiated surface elements in land estimation for the purpose of consolidation proceedings (districts are colored)

In the cases where the estimated rates were expressed in dt of rye grain, only in pomorskie region it was determined that the values of the classes were assumed according to the estimated rates and tax districts resulting from data in Table 1.

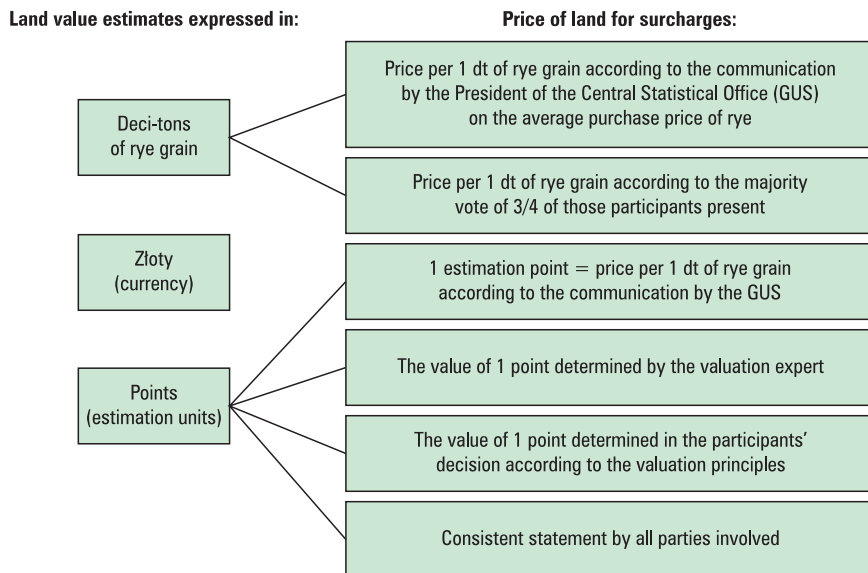
The next step of the research was to analyse the results of the survey in response to a question regarding the usually adopted method of estimating land value. Surveyors-designers of consolidation proceedings were asked to declare one of the proposed forms, or alternatively to describe their own concept. More than 59% of respondents declared that they used the traditional method (Figure 7).

Further analysis of the applied estimation methods concerned the method for determining the value of land for surcharges. It was found that 6 methods had been used (Figure 8).



Source: authors' study

Fig. 7. Responses given by the surveyors-designers of consolidation proceedings regarding the adopted methods of estimating land value



Source: authors' study

Fig. 8. Analysis of land estimation procedures used in Poland

Among the 41 analysed objects, the most commonly used method for determining the price of land for surcharges is the reference to the price of rye grain quoted in the communication by the President of the Central Statistical Office (GUS) – concerning 35% of all objects (Table 3).

Table 3. Number of objects of consolidation proceedings by type of land value and method of determining the price of surcharges

Land value	Method	Number of objects		Regions involved
Points (estimation units)	Based on rye prices according to the communication by the President of the Central Statistical Office	8	20%	łódzkie małopolskie śląskie
	The value of 1 point determined in the decision by the participants in the consolidation proceedings	5	12%	lubelskie mazowieckie podkarpackie świętokrzyskie
	The value of 1 point determined by the valuation expert	3	7%	małopolskie
	Based on the consistent statement by all parties involved	3	7%	dolnośląskie
	No price determination in the decision by the participants	3	7%	dolnośląskie mazowieckie
		Σ	53%	
Deci-tons of rye grain	Based on rye prices according to the communication by the President of the Central Statistical Office	6	15%	łódzkie pomorskie
	Based on the price determined in the decision by the participants in the consolidation proceedings	2	5%	pomorskie świętokrzyskie
		Σ	20%	
Złoty (currency)	–	11	27%	lubuskie mazowieckie podlaskie pomorskie

Complementing the above analyses, are the respondents' answers regarding the surcharges. The questions and answers were as follows:

Questions:

Surcharge amounts: How are the prices of land included in the consolidation agreed (in the case of land estimated in points / units of estimation – how is the value of 1 point determined in terms of currency?) Who sets the surcharge amounts? When and at what stage of the consolidation proceedings is it done?

Obtained answers:

- *At earlier meetings regarding the estimated value, average market values of the properties in the consolidation area must be presented, and then the value in Polish zloty of 1 estimation point must be derived.*
- *I determine the price in the proposed rules based on the analysis of notarial deeds, and the information about the turnover of land from various sources (internet, information from the participants).*
- *Land prices adopted for surcharges are agreed upon at the general meeting of the participants of the consolidation procedure, and are generally reflecting the price of land traded by the State Treasury. The value of 1 point is derived from the value of class-highest land within a given area (e.g. one hectare of class I 30 000.00–1 point 300.00 zł).*
- *At the meeting with the council, the methodology of surcharges is discussed. The council decides whether the surcharge will be based on the estimation by the value estimation expert, or whether they will adopt an appropriate multiplication of the price per quintal of rye instead. Then, additionally, the participants express their views on the matter, explaining which form is preferable to them. If they choose the point evaluation by the valuation expert, then the starost will decide when this estimation is to take place: at the beginning or at the end of the consolidation procedure. This is usually done at the end of the consolidation procedure, if it is necessary to value the estimation point.*
- *Property valuation expert – opinion on the average value of land with parameters set in a given area – either at the stage of defining the rules or before issuing the decision*
- *In the case of land consolidation, in which I participate, the value of the estimation point was not converted into currency.*
- *The highest value is given to the land within the investment and habitat areas, e.g. 300 points, then the highest grade of arable land and green land within the given object – for example, 100 points; the price per 1 ha in top-grade arable land is determined by the commission on the basis of free market prices in the area, ANR data and discussions on how the farmer could, for example, apply for the reduction or enlargement of farms. This is agreed by the consolidation commission at the meeting regarding the value estimation.*

4. Conclusions

The authors of this paper undertook research into land estimation for the purposes of consolidation proceedings in Poland. The legal grounds for land estimation as set out in the applicable legislation have been analysed. An estimate documentation for 41 consolidated objects was collected and analysed, and a part of the results of an anonymous survey addressed to surveyors-designers performing land assessment activities for consolidation proceedings were presented.

The collected data allowed us to draw the following conclusions:

1. There is no uniformity in the way land is assessed for the purpose of consolidation proceedings in Poland.
2. The adopted estimation strategy largely depends on the knowledge and professional experience of the surveyor-designer of the consolidation proceedings, who develops a project (draft) of land estimation principles.
3. The method for determining the value of land with respect to 1 ha of land, and the price of 1 dt of rye grain according to the rates given in the provisions on agricultural tax, is incompatible with the principles of property valuation, as specified in the law on Real Estate Management [Ustawa... 1997] and the Regulation by the Council of Ministers [Rozporządzenie... 2004].

References

- Cymerman R., Nowak A., Kotlewski L., Podciborski T. 2013. Podstawy rolnictwa i wycena nieruchomości rolnych, wyd. 3. Educaterra, Olsztyn, 133.
- Czechowski P. 2015. Prawo rolne. Wolters Kluwer, Warszawa, 321.
- Kłuźniak S. 1932. O naszej komasacji. Przegl. Miern., 6–7, 116, 119.
- Krzyżanowski W. 1928. Scalanie gruntów. Drukarnia Leona Wierzbickiego w Tarnopolu, Tarnopol, 119.
- Noga K. 1991. Instrukcja wykonywania szacunku gruntów w terenach górskich. Biul. Region. Zakł. Upowsz. Post. AR w Krakowie, 292, 37.
- Ostrowski K. 1932. Teoria i praktyka naszej komasacji. Rolnictwo, 4(3), 1, 31.
- Sawicki K. 1933. Klasyfikacja w kratki. Przegl. Miern., 12, 258.

Legal acts and regulations

- Rozporządzenie Rady Ministrów z dnia 21 września 2004 r. w sprawie wyceny nieruchomości i sporządzania operatu szacunkowego (<https://www.lexlege.pl/rozporzadzenie-rady-ministrow-w-sprawie-wyceny-nieruchomosci-i-sporzadzania-operatu-szacunkowego/>, accessed: 2017).
- Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 30 kwietnia 2012 r. w sprawie szczegółowego trybu sprzedaży nieruchomości Zasobu Własności Rolnej Skarbu Państwa i ich części składowych, warunków obniżenia ceny sprzedaży nieruchomości wpisanej do rejestru zabytków oraz stawek szacunkowych gruntów (<http://isap.sejm.gov.pl/DetailsServlet?id=WDU20120000540>, accessed: 2017).
- Ustawa z dnia 26 marca 1982 r. o scalaniu i wymianie gruntów (<https://www.lexlege.pl/ustawa-o-scalaniu-i-wymianie-gruntow/>, accessed: 2017).
- Ustawa z dnia 19 października 1991 r. o gospodarowaniu nieruchomościami rolnymi Skarbu Państwa (<https://www.lexlege.pl/ustawa-o-gospodarowaniu-nieruchomosciami-rolnymi-skarbu-panstwa/>, accessed: 2017).
- Ustawa z dnia 21 sierpnia 1997 r. o gospodarce nieruchomościami (<https://www.lexlege.pl/ustawa-o-gospodarce-nieruchomosciami/>, accessed: 2017).

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