sciendo

Slovak Journal of Civil Engineering

Vol. 26, 2018, No. 4, 50 – 55

DOI: 10.2478/sjce-2018-0028

EVALUATION OF THE STATUS OF REAL PROPERTY IN RURAL AREAS

Ľubica HUDECOVÁ,[1]*, Robert GEISSE[1]

Abstract

Municipalities have a great deal of interest in land consolidation. Deciding which municipality is going to be prioritized for land consolidation is not easy; a unified universal selection procedure does not currently exist.

The article proposes a procedure for assessing land ownership in a municipality. Municipalities with the worst ratings should be prioritized for land consolidation. The selection of evaluation parameters and their classification into groups is the result of previous experience. The parameters cover a broad spectrum of variables, economic conditions, the spatial structure of the agricultural land, the fragmentation of land and land ownership, the ecological stability of the land, territorial endangerment as well as natural conditions, technical limitations, and other regional specifics. The proposed quantification of the status of real property can be used with the aim of prioritizing municipalities, even with a variable number of evaluation parameters. To test the proposed algorithm, analyses were carried out in three municipalities located in west Slovakia. The municipalities were ranked according to the need to perform land consolidation

Address

[1] Department of Surveying, Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Bratislava, Slovak Republic

* ***Corresponding author:*** lubica.hudecova@stuba.sk

Key words

- Land consolidation,
- Ownership,
- Land fragmentation,
- Evaluation model,
- Factors,
- Rural areas.

1 INTRODUCTION

There are several factors influencing the functional use of agricultural land; one of them is the status of real property. Years of social, economic and historical transformations in the Central European countries have created numerous problems that also have affected landholdings (Sklenička et al., 2014; Leń and Mika, 2016). Errors in the status of real property are common in many Central European countries.

A clear distinction between the ownership of land and land use was introduced in Slovakia in 1950. The results of this distinction include conflicts between farmland users and farm owners lasting to this day. Farming is independent of the ownership registered on the owner´s folio. Large corporations operate on the fields which were created after collectivization. Land use is legally processed through thousands of lease agreements with co-owners of small plots. The state of land tenure is not a practical problem for agricultural production, but is a problem for landowners who want to use it for agricultural purposes themselves. The owners of land are significantly disadvantaged and prefer to lease their land. Statistically, 90% of the agricultural land in Slovakia is utilized through leasing agreements. The high concentration of agricultural production in Slovakia leads to a cumulation of most of the volume of EU subsidies into the hands of only a few applicants. The consequences of the ownership conditions in Slovakia include restrictions on the usability of property rights, lower economic utilization of the land, and changes to the character of a landscape. This situation also affects the profitability of farm holdings, hampers rational land management, propels disorganization

of agricultural work, and discourages operating in the real property market (Schwarcz et al., 2013; Lazíková et al., 2015; Muchová et al., 2016; Ivan and Chebeňová, 2016). The most discussed and specific issues for Slovakia are:

– Internal land fragmentation - the number of plots with one owner, plot size, shape, distance and access (Van Dijk, 2003).
– Land ownership fragmentation (shared ownership) - the number of landowners who own a given piece of land (Van Dijk, 2003).
– Land use fragmentation - the number of users that are also tenants of the land (Van Dijk, 2003).
– Agricultural land under state control (Hudecová et al., 2017).
– A large number of unknown owners, i.e., owners without identification such as an address or date of birth and owners whose names are unknown (Hudecová et al., 2017).

The long-term interest of the state is to resolve injustice against property owners. "Land consolidation" (hereinafter referred to as "LC") was designated to be the main tool in this process. In the year 1991, Act No. 330 on land consolidation, the arrangement of real property, land register offices, land funds and land communities (Act No. 330/1991) came into force. In accordance with this Act, the term "LC" is understood to mean the consolidation, division, dislocation and arrangement of lots on the basis of ownership, land use relations, and related executions of fields, communication, water control management, re-cultivation and fertilization measures. At the same time ecological measures were also established for LC in order to rationalise agricultural operating conditions and secure the stability and aesthetic appearance of agricultural land (Hudecová, 2015). The role of the state is provided by land departments (district offices that perform state administration in the LC section). The technological procedures for performing LC are detailed and available. The weakest point is the selection of areas where LC will be performed (Muchová et al., 2016). Municipalities have a great interest in LC; there has been no optimal selection of areas for consolidation yet. The same problems can be observed in neighbouring countries (Sklenička et al., 2014; Leń and Noga, 2018).

The aim was to propose a universal algorithm for the assessment of the status of real property in a municipality (LAU 2) that can be used for the prioritization of LC.

2 MATERIALS AND METHODS

2.1 Model to evaluate the status of real property

The large volume of information on economic, social, cultural, environmental and land ownership aspects requires analytic methods that can integrate these aspects according to their impact on the final outcome. Multi-criterial analysis is one method that can be used for solving such complex problems. It represents a decision-making analysis that is able to quantitatively evaluate alternatives by taking into account different perspectives and priorities to produce a common output (Iojă et al., 2014; Leń and Mika, 2016).

A multi-criterial evaluation requires several steps: the selection of indicators (factors) to be ranked, determination of their sources, identification of the criteria that will influence the outcomes (classification of factors), normalization of factors (standardisation) and assignment of "weights" to the factors, and determination of the final values of the land property´s status (even with a variable number of factors), Figure 1. The steps "2.1" and "3.1" in Figure 1 are optional, depending on the statistical method used and the factor itself.

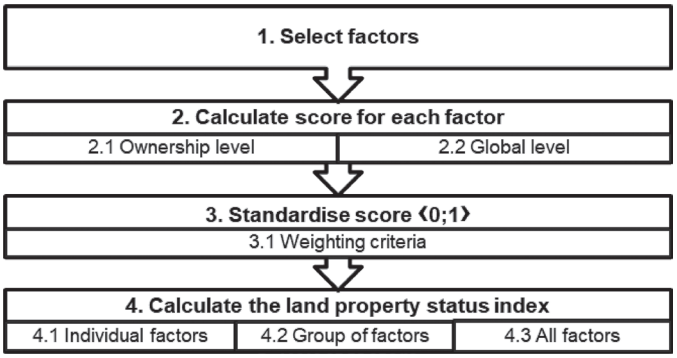

Fig. 1 *Outline of the model for evaluating the status of real property*

2.2 Evaluation factors and their classification

The set of factors that are useful for analysing the status of real property is extensive. They cover a broad spectrum of variables, including the economic conditions, the spatial structure of the agricultural land, the fragmentation of the land and land ownership, the ecological stability of the land, any territorial endangerment as well as natural conditions, the technical limitations, and other regional specifics. The scores of the factors are measured using different scales (percentage, inhabitants, numbers, area, rate of growth). It is useful to perform a more detailed sorting to allow the selection of more factors (categories or groups) to be entered into the calculations.

It is assumed that all the variables selected are statistically significant and have a positive or a negative effect on the LC. If necessary, the standardisation of diagnostic features is a preliminary step (Fig. 1). Different appropriation methods (e.g., using value functions) can be used. The statistical methods for standardisation of the scores have been described in detail in several papers (Demetriou et al., 2012; Leń et al., 2016). For variables that are statistically more significant, weights can be assigned.

2.3 Algorithm for evaluation of the status of real property

The standardised scores of the factors are integrated into the multi-criterial evaluation. The algorithm for the evaluation of the status of real property should be universally applicable, through the use of an optional number of factors in the calculations. Municipalities with the worst ratings are more suitable for LC; they should be prioritized by the state.

2.4 Study areas

To test the proposed algorithm, the computation was carried out in three municipalities located in two regions (Nomenclature des Unitées Territoriales Statistiques - NUTS3) and two regions (NUTS2) in west Slovakia (Figure 2). The basic information about the areas tested is in Tab. 1.

The shape of the plots in all the areas examined is commonplace for Slovakia (Fig. 3). The land ownership fragmentation (in Table 1, the raw "average of shared ownership per plot") has the highest value of "6.24" in Sebedražie; the amount of landowners who own a given piece of land is displayed in Fig. 3.

Tab. 1 *Basic information about the areas examined*

Municipality (LAU2)	Petrova Ves	Primoravské lúky	Sebedražie
Region (NUTS3)	Trnava	Trnava	Trenčín
District (NUTS4)	Skalica	Skalica	Prievidza
Area examined [ha]	1242	154	695
Number of plots	3293	424	2785
Number of owners	1960	929	1548
Number of ownership relations	13,470	1819	49,030
Average plot area	0.37 ha	0.36 ha	0.32 ha
Average of shared ownership per plot	4.04	4.30	6.24
Average number of lots per owner	6.87	1.96	8.64

3 RESULTS

3.1 Classification of factors

The classification of factors is the result of previous experience (Muchová and Antal, 2013; Hudecová et al., 2017). The factors are divided into 2 categories (general and specific) and 7 groups to allow for the selection of factors to be entered into the calculations. The general factors provide a comprehensive view of the landscape, land structure, natural and economic conditions, and agricultural productivity in the area examined. The specific factors characterize the land use fragmentation, land ownership fragmentation, internal land fragmentation, and other inconsistencies of the property rights.

The category of general factors is divided into 3 groups: A - factors related to the current state of the landscape and land structure (17 factors), B - factors related to the natural and economic conditions (6 factors) and C - factors related to the agricultural productivity (2 factors), Tab. 2. The scores of the general factors are measured according to different scales. The data are available from land, environmental, and cadastral departments; the Statistical Office of the Slovak Republic (Mapportal); the National Agriculture and Food Centre (Soil portal; LPIS); the Geodesy, Cartography and Cadastre Authority of the Slovak Republic (Cadastral portal; Geoportal); and the Slovak Environmental Agency (Enviroportal).

The category of specific factors is divided into 4 groups, i.e., D – related to any internal land fragmentation (4 factors), E - factors related to land ownership fragmentation (2 factors), F - factors related to land use fragmentation (6 factors) and G - factors related to other property rights inconsistencies (2 factors), Tab. 3. Factors D and E correspond to the sub-problems that constitute land fragmentation and which can be recognised in many post-socialist countries. Factors F and G correspond to the problems specific to Slovakia. The scores of the specific factors are indexes. Value functions have been proposed to set their standardised scores. The data of specific factors are available from the cadastral departments and from the Statistical Office of the Slovak Republic (Mapportal).

Fig. 2 *Examined areas of Petrova Ves and Primoravské lúky in the region of Trnava, Sebedražie in the region of Trenčín*

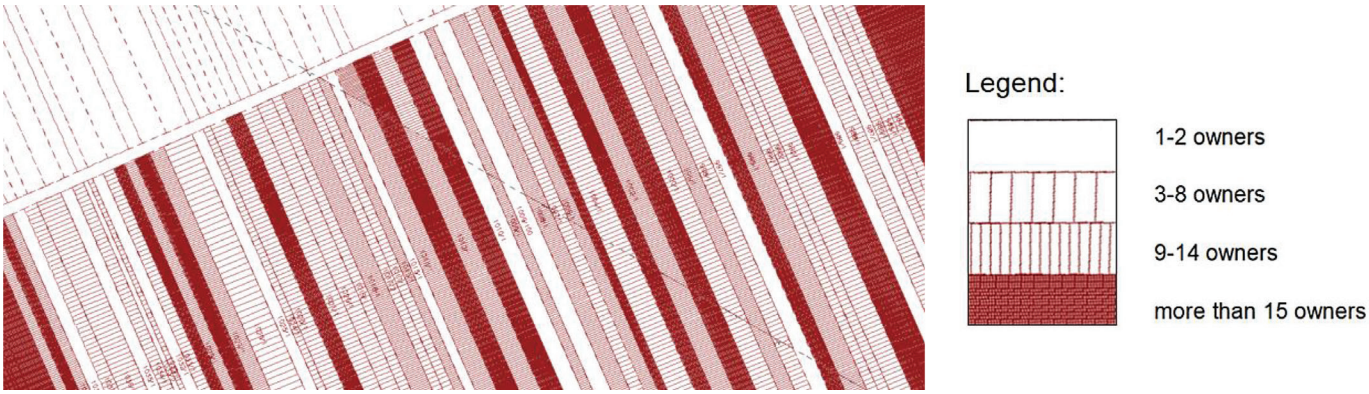

Fig. 3 *Land ownership fragmentation (municipality of Sebedražie – subsection)*

Tab. 2 *Category General factors*

A - General factors about the current state of the landscape and land structure	
A1	population
A2	number of landowners living in a municipality
A3	total area of cadastral district (hereinafter referred to as c.d.) [ha]
A4	area of c.d., that is eligible for LC [ha]
A5	number of plots per ha
A6	plot area of agricultural land [ha]
A7	plot area of hop fields, vineyards and orchards [ha]
A8	plot area of forests [ha]
A9	number of agricultural cooperatives
A10	number of trading companies and other entities
A11	number of independent farmers
A12	area of plots in all farm holdings [ha]
A13	area of land owned by the municipality [ha]
A14	area of land owned by churches [ha]
A15	area of land in agricultural cooperatives holding [ha]
A16	area of land in trading companies and other legal entities holding [ha]
A17	area of land in independent farmer holdings [ha]
B - General factors about the natural conditions and economic conditions	
B1	areas in need of improvement of economic situation [ha]
B2	areas allocated for social and municipal interests [ha]
B3	areas with low ecological stability, indications of soil degradation or in need of soil protection [ha]
B4	areas with vulnerability zones [ha]
B5	areas used for non-agricultural purposes [ha]
B6	agricultural land with limited use, e.g., Roma settlements [ha]
C: General factors about the agricultural productivity	
C1	productivity potential of arable land
C2	productivity potential of other agricultural land

3.2 Universal algorithm for evaluation of the status of real property (for factors *D* and *E*)

The land property status index (LPS) is calculated based on all the weighted factors:

$$LPS = \sum_{i=1}^{n} F_i \times w_i \tag{1}$$

where: *F* - standardised score of a factor,
n - number of factors to calculate,
w - weight of a factor.

The distribution of the weights of the factors can be adapted to the number of factors. The sum of the weights is always equal to one.

Tab. 3 *Category Specific factors*

D - Specific factors about any internal land fragmentation	
D1	shape of a plot
D2	dispersion of a plot
D3	size of a plot
D4	number of plots
E - Specific factors about land ownership fragmentation	
E1	shared ownership
E2	owner relationships
F - Specific factors about land use fragmentation	
F1	land owned by cooperatives
F2	land owned by trading companies and other legal entities
F3	land owned by individual farmers
F4	users that are also tenants of the land
F5	areas where the user is also a tenant of the land
F6	road access
G - Specific factors of other inconsistencies of property rights	
G1	land under state control
G2	land occupied by unknown owners

3.3 Evaluation of the status of real property for a group of selected factors (*D* and *E*)

The selected factors are: *D1* (shape of a plot), *D2* (dispersion of a plot), *D3* (size of a plot), *D4* (number of plots), *E1* (shared ownership), and *E2* (owner relationships).

The standardised scores of all the factors are valued in an interval of (0;1). The calculation of the standardised scores for factor *D1* (shape) and for factor *D2* (dispersion) was proposed by Demetriou et al. (2012); the formulas are universal and can be used for every country with any land tenure conditions.

The calculation of the standardised scores for factors *D3, D4, E1* and *E2* was adapted to Slovak conditions; the value functions (2), (3), (4) and (5) were used, respectively. The scores of the *D3, D4* and *E1* factors were calculated through the ownership level; their global level was then calculated as the mean.

The standardised score for factor *D3* (size of a plot) (Hudecová et al., 2017) is:

$$D3 = \frac{1}{12600} \times a - \frac{2}{63} \tag{2}$$

where: *a* – area of one plot in m^2.

The standardised score for factor *D*4 (number of plots) (Hudecová et al., 2017) is:

$$D4 = \frac{1}{opn} \tag{3}$$

where: *opn* – owner plot number.

The standardised score for factor *E1* (shared ownership) is:

$$E1 = \frac{n}{d} \tag{4}$$

where: *n – numerator in the fraction in one relationship,*
d – denominator in the fraction in one relationship.

The standardised score for factor *E2* (owner relationships) is:

$$E2 = \frac{pn}{or} \quad (5)$$

where: *pn – plot number in whole area examined,*
or – owner relationship.

The land property status index (LPS) is:

$$LPS = \sum_{i=1}^{6} F_i \times w_i \quad (6)$$

where: *F* - standardised score of the *D1, D2, D3, D4, E1* and *E2* factors.
w - weight of factor.

3.4 Verification of the proposed algorithm using groups of factors *D* and *E*

The universal algorithm for the evaluation of the status of real property was tested for the group of *D* and *E* factors in the 3 areas examined. All the variables in the three municipalities were gathered from cadastral department databases. The Visual Basic for Applications (VBA) included in Excel was used. The standardised scores for the individual factors in the examined area of Primoravské lúky are in Tab. 4. The weight distribution for the computations is in Tab. 5 (Turan, 2017). The evaluation of the status of the real property in the three areas examined, i.e., Primoravské lúky, Petrova Ves, and Sebedražie, is in Tab. 6.

Tab. 4 *Standardised scores for individual factors in the Primoravské lúky area*

Factors	Standardised scores
D1 - shape of a plot	0.09
*D*2 - dispersion of a plot	0.45
*D*3 - size of a plot	0.26
*D*4 - number of plots	0.05
*E*1 - shared ownership	0.34
*E*2 - owner relationships	0.24

Tab. 5 *Weight distribution for the groups of D factors (internal land fragmentation) and E (land ownership fragmentation)*

Factors	Weights
*D*1 - shape of a plot	0.03
*D*2 - dispersion of a plot	0.01
*D*3 - size of a plot	0.01
*D*4 - number of plots	0.05
*E*1 - shared ownership	0.45
*E*2 - owner relationships	0.45

Tab. 6 *Land property status index with weight distribution according to Tab. 5*

Area examined	Land property status index
Sebedražie	0.11
Petrova Ves	0.25
Primoravské lúky	0.27

The results achieved show that the comparatively worse status of the real property (from the perspective of land use fragmentation and land ownership fragmentation) is in Sebedražie (the lowest index).

In order to determine which areas should be prioritized for LC, the standardised scores of all groups of factors were calculated. The zero unitization method and the method of transformation to percentage were used for the final values; the results are in Tab. 7. Which area will be prioritized for consolidation will affect the final weight distribution.

Tab. 7 *Standardised scores for the group of factors*

Area examined	Standardised scores for the group of factors					
	A	B	C	D and E	F	G
Sebedražie	0.23	0.13	0.70	0.11	0.50	0.17
Petrova Ves	0.17	0.10	0.40	0.25	0.30	0.34
Primoravské lúky	0.18	0.16	0.40	0.27	0.30	0.23

The factors we were focusing on; the status of real property (E and D factors), are exceptional by the fact that immediately after the end of LC we can determine how they have improved in consolidation process, Tab.8. For this reason, we have tested the areas in which consolidations have already been completed. Table 8 lists land property status index for the group of factors D and E before and after LC.

Tab. 8 *Land property status index before and after LC process for the group of factors D and E*

Area examined	Land property status index	
	before LC	after LC
Sebedražie	0.11	0.21
Petrova Ves	0.25	0.53
Primoravské lúky	0.27	0.75

4 CONCLUSIONS

Slovakia is changing its land tenure arrangements to improve environmental conditions, resolve conflicts, and facilitate economic development. LC is a tool of the state capable of solving current land tenure issues. The optimal selection of areas for LC is still not resolved. In the present study an attempt has been made to develop a universal algorithm for the evaluation of the status of real property with the aim of prioritizing LC for municipalities where the situation is the worst. In the first part 42 factors which characterize landscapes (in rural areas) as a whole were established. The factors were set out in (Tabs. 2, 3), and the source databases were defined. The universal rules and approaches for developing a universal algorithm for evaluating the status of real property was defined (Fig. 1). The advantage of the proposed solution is that any number of factors can be entered into the calculations. If all the variables are standardised (valued in the interval between 0 and 1), the calculations are simple. In the second part of the study presented, the universal algorithm for the assessment of land property status was tested for 6 selected factors in the 3 areas examined. The results prioritized the municipality of Sebedražie for LC processes (Tab. 6).

REFERENCES

Act No. 330/1991 *Coll. on land consolidation, arrangement of land property, land register offices, land fund and land communities, as amended.*

Lazíková J. - Takáč I. - Schwarcz P. - Bandlerová A. (2015) *Agricultural Land Market in Slovakia – Economic and Legal Impacts of Law No. 140/2014 Coll. on Land Acquisition*. Agricultural Economics 61 (8), pp. 367-376.

Cadastral portal of the Geodesy, *Cartography and Cadastre Authority of the Slovak Republic*, URL: https://www.katasterportal.sk (accessed 29.03.2018).

Demetriou D. - See L. - Stillwell J. (2012) *Spatial multi-criteria model for the evaluation of land redistribution plans*. International Journal of Geo-Information 1(3), pp. 272-293.

Enviroportal of the Slovak Environmental Agency, URL: http://geo.enviroportal.sk/ (accessed 29.03.2018).

Geoportal of the Geodesy, *Cartography and Cadastre authority of the Slovak Republic geoportal*, URL: http://geoportal.gov.sk/ (accessed 29.03.2018).

Hudecová Ľ. (2015) *The effectiveness of land consolidation in Slovakia. Proc. FIG Working Week 2015*, 13 pp.

Hudecová Ľ. - Geisse R. - Gašincová S. - Bajtala M. (2017) *Quantification of land fragmentation in Slovakia.* Geodetski list, 4, pp. 327-338.

Iojă I.C. - Niță M.R. - Vânău G.O. **- Onose D.A. - Gavrilidis A.A. (2014)** *Using multi-criteria analysis in identifying spatial land-use conflicts in the Bucharest Metropolitan Area.* Ecological Indicators, 42, pp. 112-121.

Ivan P. - Chebeňová T. (2016) *Assessment of the ecological stability of the village of Bielovce as a result of to changes in land use.* Slovak Journal of Civil Engineering 24 (2), pp. 1-6.

LPIS - Land production information system of the National Agriculture and Food Centre URL: https://podnemapy.vupop.sk/ (accessed 29.03.2018).

Leń P. - Mika M. (2016) *Determination of the urgency of undertaking land consolidation works in the villages of the Sławno municipality*, Journal of Ecological Engineering 17, pp. 163–169.

Leń P. - Noga K. (2018) *Priorization of land consolidation interventions in the villages of central Poland*. Journal of Ecological Engineering 19 (2), pp. 246-254.

Leń P. - Oleniacz G. - Skrzypczak I. - Mika M. (2016) *The Hellwig's and zero unitarisation methods in creating a ranking of the urgency of land consolidation and land exchange work*. Proc. 16th International Multidisciplinary Scientific GeoConference SGEM 2016, 2 (2), pp. 617-624.

Mapportal of the Statistical Office of the Slovak Republic, URL: http://udaje.statistics.sk/statdat/ (accessed 29.03.2018).

Muchová Z. - Antal J. (2013) *Pozemkové úpravy (Land consolidation)*. Slovak University of Agriculture, Nitra: Garmond Nitra, 336 pp. ISBN 978-80-552-1130-5 (in Slovak).

Muchová Z. - Leitmanová M. - Petrovič F. (2016) *Possibilities of optimal land use as a consequence of lessons learned from land consolidation projects (Slovakia).* Ecological engineering (Amsterdam: Elsevier), 90, pp. 294-306.

Schwarcz P. - Bandlerová A. - Schawarczová L. (2013) *Selected issues of the agricultural land market in the Slovak Republic.* Journal of Central European Agriculture, 14 (3), pp. 1102–1115.

Sklenička, P. (2006) *Applying evaluation criteria for the land consolidation effect to three contrasting study areas in the Czech Republic*. Land Use Policy, 23(4), pp. 502-510.

Sklenička P. - Janovská V. - Šálek M**. - Vlasák J. - Molnárová K. (2014)** *The Farmland Rental Paradox: Extreme land ownership fragmentation as a new form of land degradation*. Land Use Policy 38, pp. 587-593.

Soil portal of the National Agriculture and Food Centre, URL: http://www.podnemapy.sk (accessed 29.03.2018).

Turan P. (2017) *Výpočet miery rozdrobenosti pozemkového vlastníctva (The calculation of the fragmentation of land ownership*. Bc. Thesis, Slovak University of Technology, Faculty of Civil Engineering, Bratislava, 39 pp.

Van Dijk T. (2003) *Scenarios of Central European land fragmentation.* Land Use Policy, 20, pp. 149-158.