Analysis of the effects of land consolidation. Case study: Šašinci

Marina Davidović[1*], Jelena Tatalović[2], Milan Trifković[2] ,Ljubiša Manojlović,Bogdan Bojović[2]

[1]Faculty of Tehnical Sciences, Novi Sad, Republic of Serbia
[2]Faculty of Civil Engineering, Subotica, Republic of Serbia

Paper type: Review paper
Received: 24.4.2023.
Accepted: 28.6.2023.
Published: 30.9.2023.

UDK: 528.46
DOI: 10.14415/JFCE-890
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Abstract:

In the last few years, in the Vojvodina, starting-up and realization of the land consolidation projects have become more and more frequent. Therefore, land consolidation represents an area that is in extreme expansion, and which, according to the amount of funds invested in its launch and realization, represents a significant segment for the units of local self-government and the state itself. This paper deals with the analysis of the effects achieved by the land consolidation projects. Following metric data before and after land consolidation were used: number of parcels, average size of the parcel, area under the road and canal network, etc. The cadastral municipality (hereinafter, CM) Šašinci was taken as the subject municipality. In addition, for comparative analysis are used data from other CMs in Vojvodina, where land consolidation was also carried out. Based on figures and charts presented in paper, it can be concluded that the benefits of land consolidation are great. The number of parcels was reduced by an average of 59% per CM. The surface of the road and canal network increased significantly, as well.

Keywords:
land consolidation, Šašinci, cadastral municipality, comparative analysis

1 Introduction

Surveying engineers have a major role in implementing of land consolidation projects and coordinating of all project activities. The most important activities are the collection of information about land owners, land surveying and valuation, as well as negotiation and communication during the implementation process with all participants. On average, the period of implementation of land consolidation projects lasts from 2 to 3 years, up to a maximum of 5 years, which depends on the number of involved landowners, the existing property-legal relations on the land, the degree of fragmentation of the land and the willingness of the landowners to be cooperative and participate in constructive negotiations [1].

Traditional procedures have achieved significant improvements over time, including more and more activities related to the complete arrangement and development of rural areas. Over time, as a result of acquired experience and technological progress, different approaches in land consolidation have been developed. Likewise, the objectives of land consolidation have changed. Current land consolidation procedures are an important instrument of rural development and have a much wider focus than agricultural production itself [1].

* corresponding author: marina.davidovic@uns.ac.rs

According to [2 and 3], the main goal of land consolidation projects is to remove and change the limiting natural factors of arable land. The authors [4] point out that these projects simultaneously ensure land availability, environmental improvement and ecological stability, as well as soil and water protection.

The biggest challenges for faster and more efficient land consolidation are financing and the lack of appropriate professional staff engaged in the implementation of projects. The Law on Land Consolidation, which is being prepared, foresees that the entire concept of land consolidation is planned from one place and implemented in a synchronized manner. For that purpose, the necessary financial resources will be provided at the national level.

With the new legal provisions, funding will be centralized at the state level and will be carried out in a planned manner, and local self-governments will get competent professional staff in the implementation of the land consolidation procedure. In this way, better efficiency of the entire process will be enabled.

This work is divided in several units. In the theoretical part, the processes, phases and effects of land consolidation are discussed. The research paper part is focused on the effects of the implemented land consolidation in CM Šašinci. Afterwards, a comparative analysis of the land consolidation effects in following CMs is presented: Radenković, Pločice, Skorenovac, Uljma, Izbište and Vlajkovac. In the end is discussion of the obtained results, and concluding considerations.

2 Theoretical basis of land consolidation

2.1 Land consolidation definition

Land consolidation is derived from the Latin word *commasare*, which translated into Serbian would mean - to collect in a mass. Many authors give different definitions of land consolidation. According to [5], it implies a system of spatial-planning, technical, legal and economic-social measures that the social community undertakes for the fundamental improvement of the natural, economic and ecological conditions of the land territory. Land consolidation is a term that has a precise meaning and refers to the expansion of parcels. Land consolidation and resettlement problems usually involve the regrouping of fragmented parcels [6, 7]. According to [8], it is a system that includes planning, organizational, legal, economic and technical measures that should be implemented in order to increase and improve the natural and ecological conditions of the land. In general, it can be said that land consolidation projects aim to increase the value of a certain area [9].

2.2 Basic phases of land consolidation

Through each land consolidation model, the following work groups can be distinguished:

- Preparatory works,
- Previous works,
- Production of the main project,
- Realization of works, and
- Final works [5].

In the phase of preparatory works, selection and the boundaries of the land consolidation area are determined, all necessary data are collected, the area is analysed, all the problems faced by the rural community are identified and the population is informed [5].

The phase of previous works includes all the works that precede the development of the main land consolidation project, such as: gathering the data from public records on real estate and spatial and urban plans, strategic documents, basics of agricultural land management, water management basics, programs and projects, documentation on roads, program for

protection and improvement of forests and biodiversity, statistical data on the population, households, agricultural machinery, economic indicators, provision and preparation of geodetic bases for design, determination of the factual situation of immovable properties, assessment of land and buildings [5,10].

The main land consolidation project is prepared in accordance with the program by thematic units, which must be synchronized and mutually harmonized. The main project includes designing:

- Purpose of surfaces,
- Drainage system,
- Irrigation system,
- Agricultural protection forest belts,
- Land protection from water erosion,
- Environmental protection,
- Corrections of boundary lines,
- Rural roads,
- Technical arrangement of the field,
- Parceling and grouping of parcels,
- Urban development of rural settlements,
- Geodetic foundations (new polygonal and leveling networks),
- Geodetic marking of buildings, boards and parcels, and
- Organization of works [5].

The phase of realization of works from the main project is the phase that includes field and office work for all activities from the main project. Seen from the aspect of geodesy, this phase ends with the establishment of the real estate cadastre.

The enumerated activities per phases are basically the same for all land consolidation models, but their content and scope of work depend on the model itself, the characteristics of the area and the planned landscaping interventions. Based on this, it can be seen that geodetic works are an integral part of all phases of land consolidation and are significantly more extensive compared to others [5].

3 Area of research

Šašinci is a settlement in the city of Sremska Mitrovica, which according to statistical indicators from 2001 is included in the medium-developed municipalities of Vojvodina. The CM of Šašinci, according to RGI sources, has a total area of 3648 ha, of which the construction area occupies 278 ha.

Reasons for land consolidation of CM Šašinci are in accordance with the reasons prescribed by Article 31 of the Law on Agricultural Land, i.e., this process is carried out due to [11]:

- The needs of grouping fragmented cadastral parcels of agricultural land owners (the average size of which is 0,62 ha), as well as the grouping of state land,
- Designing a new road network in accordance with the technical solution of roads, canals and agricultural protection belts and recultivation of the surfaces of old rural roads,
- Construction of agricultural protection forest belts,
- Correction and expansion of the boundaries of the construction area,
- Implementation of irrigation and drainage system projects for agricultural land, which have been established for the consolidated area, and
- Resolution of property-legal relations and creation of a new state survey and real estate cadastre.

In parallel with land consolidation, in the area of Šašinci municipality, the renewal of the survey is also needed. The survey was carried out in 1937-1940 years. The survey is in the hvatsky measurement system, in stereo-graphic projection, and the cadastral plans are made in the scale 1:1440 and 1:2880. The sheets of cadastral plans, which are about 75 years old, are very worn out and it's difficult to register graphic changes on them. The Basic state map was created for the same area in 1953 and is quite out of date. In CM Šašinci, the area is unorganized and the cadastral plans are in a bad condition. All of the above are reasons for renewing the survey.

4 Results

This chapter refers to the research segment in which the data on the land consolidation in CM Šašinci will be presented tabular and graphically. The statistical analysis was done on the basis of parameters such as the number of parcels, the number of real estate sheets, the size of the parcels.

4.1 Analysis of the land consolidation effects of CM Šašinci

The object of this land consolidation was 3370 ha of CM Šašinci. Simultaneously with the realization of land consolidation, the survey renewal of the construction area of about 278 ha was started. Comparative data on the site before and after land consolidation in CM Šašinci are given in Table 1.

Table 1: Data on the site before and after land consolidation for CM Šašinci

	Before land consolidation (Nb)	**After land consolidation (Nb)**	**Change (%)**
No. of cadastral parcels (construction area)	1936	953	-50,77
No. of cadastral parcels (non-construction area)	2795	1363	-51,23
No. of ownership certificates	1072	985	-8,12
Avg. parcel area (non-construction area)	11993	24608	+105

It is clear from the table that there was a decrease in the number of parcels, in both areas - construction and non-construction, by more than 50%. The number of ownership certificates decreased, and the average area of one parcel increased by double (105%). In addition to the presented data, the areas under the road and canal network were analysed, after which it was concluded that these areas increased.

Figure 1 shows a part of the CM before and after land consolidation, respectively. It can be seen from the Figure that the parcels are now larger and more regular in shape, which is precisely one of its main effects.

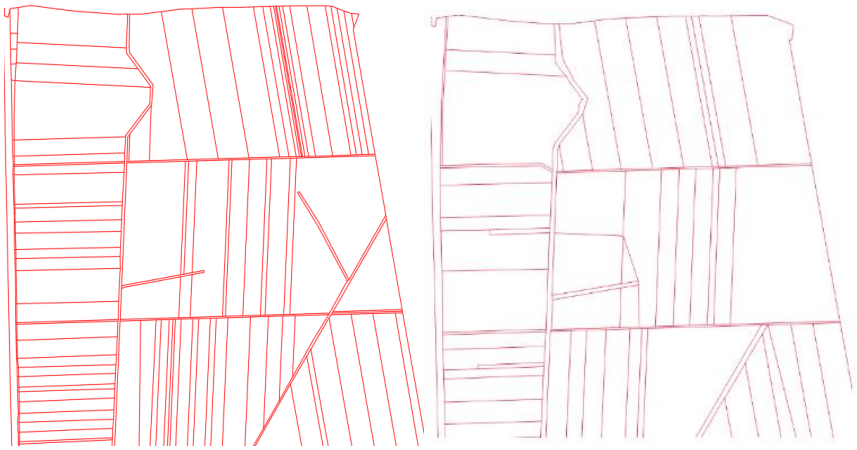

Figure 1: Presentation of the parcel distribution a) before and b) after land consolidation

4.2 Comparative analysis of the land consolidation effects

In order to see the effects of land consolidation in the area of Vojvodina, in the research phase, data on certain CMs was collected. Then a comparative analysis of the effects was performed for the following municipalities: CM Šašinci, CM Radenković, CM Pločice, CM Skorenovac, CM Uljma, CM Izbište and CM Vlajkovac. The data for the mentioned CMs were taken from the bachelor and master theses [12, 13, 14, 15].

The comparison was made according to the following parameters:

- Change of the area covered by the road network in a given CM,
- Change of the area covered by the canal network in a given CM,
- Change in the number of owners in a given CM,
- Change in the number of parcels in a given CM, and
- Used reduction coefficient in the given CM.

Table 2 contains data on the area of the road network before and after land consolidation, for CM Šašinci, Radenković, Pločice and Skorenovac. There is a trend of increasing the road network for each analysed CM, in the range of 2,39% (i.e. 25539 m² for CM Pločice) to 220,84% (i.e. 233447 m² for CM Radenković).

Table 2: Data on the road surface before and after land consolidation

CM	Before land consolidation(m²)	After land consolidation (m²)	Change (%)
CM Šašinci	775401	1011085	+30,40%
CM Radenković	105707	339154	+220,84%
CM Pločice	1069747	1095286	+2,39%
CM Skorenovac	337598	398213	+17,95%

Figure 2 contains data on the area of the canal network before and after land consolidation, for CM Šašinci, Radenković, Pločice and Skorenovac. The graph shows an increase in the canal network for each analysed CM, in the range of 1,55% (i.e. 223308 m² for CM Skorenovac) to 446,03% (i.e. 162681 m² for CM Radenković).

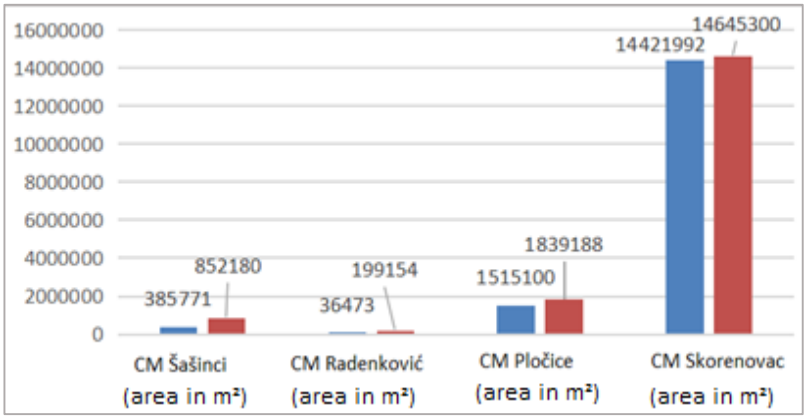

Figure 2: Graphic representation of the canal network before and after land consolidation

Comparative data before and after land consolidation related to the number of owners are given in Table 3. The number of owners was reduced in each analysed CM, from which it is clear that it is a matter of updating the data (resolving property-legal issues in the phase of determining the factual state). Those reductions range up to 14,29% (CM Izbište).

Table 3: Comparative data on the number of owners before and after land consolidation

CM	Before land consolidation (Nb)	After land consolidation (Nb)	Change (%)
CM Šašinci	1072	985	-8,12%
CM Pločice	1471	1470	-0,07%
CM Skorenovac	810	774	-4,44%
CM Uljma	2543	2234	-12,15%
CM Izbište	1505	1290	-14,29%
CM Vlajkovac	837	775	-7,41%

Table 4 contains data on the number of parcels before and after land consolidation for each CM that are subject of research. After land consolidation, the number of parcels was reduced, ranging from 45,62% (or 1494, for CM Radenković) to 76,14%, (or 9235, for CM Uljma) depending on the CM. From these statistical indicators, it is clear that one of the most significant effects was realized during land consolidation - consolidation of properties.

Table 4: Comparative data on the number of parcels before and after land consolidation

CM	Before land consolidation (Nb)	After land consolidation (Nb)	Change (%)
CM Šašinci	4731	2316	-51,05%
CM Radenković	3275	1781	-45,62%
CM Pločice	5356	2397	-55,25%
CM Skorenovac	2033	1013	-50,17%
CM Uljma	12129	2894	-76,14%
CM Izbište	8111	2085	-74,29%
CM Vlajkovac	4446	1781	-59,94%

Another statistical parameter used in this analysis is the deduction coefficient. It is calculated due to the provision of land for common needs, and it depends on the size of the consolidation area, the size of the values that are entered during its calculation, and on the opinion of the Commission for land consolidation, which percentage will be adopted.

Figure 3 shows the calculated and adopted coefficient of deduction for CM: Šašinci, Radenković, Pločice and Skorenovac. The results are aligned with expectations. Namely, the adopted deduction coefficient was increased compared to the calculated one, in the range of 0,16% (specifically, for CM Šašinci) to 0,38% (specifically, for CM Radenković), depending on the CM.

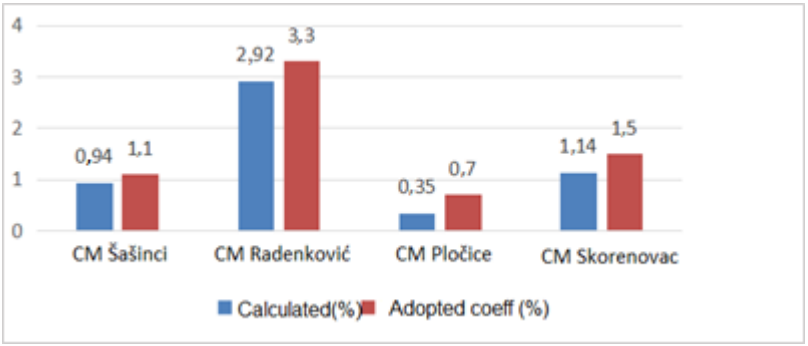

Figure 3: Graphic representation of the calculated and adopted deduction coefficient

5 Discussion

The land consolidation process has advanced the most in Vojvodina, where are located the largest consolidated areas in Serbia. According to the data of the Provincial Secretariat for Agriculture, in 24 CM in the province, which include the territory of 16 local governments, and 98,200 ha of land, were included in the land consolidation process.

Within this paper, a comparative analysis of particular CMs located over the territory of Vojvodina was carried out, in order to see the effects on concrete examples and figures.

The comparison was made according to the following parameters:

- Change in the area covered by the road and canal network,
- Change in the number of owners,
- Change in the number of parcels, and
- Used reduction coefficients.

By analysing the procedures of conducted land consolidation and combining the conditions before and after it for the mentioned parameters, it can be concluded that the following effects were achieved:

- The surface of the road network increased on average of 68% per CM,
- The area of the canal network increased on average of 147% per CM,
- The number of consolidation participants decreased by an average of 8% per CM, and
- The number of parcels was reduced by an average of 59% per CM.

6 Conclusion

The arrangement of the agricultural land facilitates the cultivation of the land by the owners themselves, and through up-to-date records and all institutions whose jurisdiction the land is [13].

The paper analyzes the results of land consolidation carried out in certain CMs in the area of Vojvodina. The effects of land consolidation are well-known from earlier, but in this paper they are clearly presented in concrete examples. The results of the research are shown in Tables 1-4, as well as in Figures 1-3. In addition to the currently visible benefits, there are also some

benefits that will be seen in future period. For example, in the land consolidation projects, the roads are projected and parcels are enlarged and grouped. Therefore, parcel owners now have to drive shorter distances to get to their land, which has a long-term impact on environment, by reducing the quantity of harmful gases.

References

[1] Trifković M., Nikić D., Božić, N. Vrednovanje i klasifikacija katastarskih opština za komasaciju u opštinama Modriča i Vukosavlje, The University of Novi Sad, The Faculty of Civil Engineering in Subotica, the Selection of Works of the Faculty of Civil Engineering, Vol.18, 2009

[2] Guanghui, J., Ruijuan, Z., Wenqiu, M., Dingyang, Z., Xinpan, W. Cultivated land productivity potential improvement in land consolidation schemes in Shenyang, China: assessment and policy implications, Land Use Policy, 68, 2017

[3] De Laurentiis, V., Secchi, M., Bos, U., Horn, R., Laurent, A., Sala, S. Soil quality index: exploring options for a comprehensive assessment of land use impacts in LCA. J. Clean. Prod., 215, 2019

[4] Moravcova, J., Koupilova, M., Pavlıček, T., Zemek, F., Kvitek, T., Pečenka, J. Analysis of land consolidation projects and their impact on land use change, landscape structure, and agricultural land resource protection: case studies of Pilsen-South and Pilsen-North (Czech Republic), Landscape Ecol Eng., 13, 2017

[5] Medić, V. Agrarne operacije, Geodetski fakultet Sveučilišta u Zagrebu, Zagreb 1978

[6] Land problems and policies, Reprint Edition Arno Press Inc., 1979

[7] Food and Agriculture Organization of the United Nations: The design of land consolidation pilot projects in Central and Eastern Europe, Rome, 2003

[8] Miladinović, M. Uređenje zemljište teritorije, Naučna knjiga, Belgrade, 1977

[9] Marinković G., Ninkov T., Trifković M., Nestorović Ž., Pejičić G., On the land consolidation projects and cadastral municipalities ranking, Tehnički vijesnik 23, 4, 2016

[10] Cakić, J., Mihajlović, M., Koncept sprovođenja komasacije u Republici Srbiji, Tehnika-Naše građevinarstvo 70 (2016)

[11] Program komasacije KO Šašinci

[12] Jokić, B. Analiza efekata komasacije. Studija slučaja opština Vršac, master rad, Fakultet tehničkih nauka, Novi Sad, 2021

[13] Đukanović, Đ. Analiza efekata komasacije na primeru KO Radenković, diplomski rad, Fakultet tehničkih nauka, Novi Sad, 2018

[14] Manojlović, Lj. Analiza efekata komasacije. Studija slučaja: katastarska opština Šašinci, master rad, Građevinski fakultet u Subotici, 2022

[15] Lazarević, B. Analiza efekata komasacije. Studija slučaja: opština Kovin, master rad, Građevinski fakultet u Subotici, 2022