The systematic registration of property law and cadastre on the territory in Romania: discussing a case study

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Abstract

The systematic registration of real estate on the territory of a state represents the way to the rapid development of the market economy by reducing transaction costs, securing property rights, reducing or avoiding corruption and attracting investors. This work presents the way to create a systematic cadastre sector in the form of a case study, in accordance with the systematic cadastre procedures at the level of Romania, and its impact on sustainable development. In Romania, systematic registration is realised in the Eterra electronic database starting with the year 2015, together with the establishment of the National Agency for Cadastre and Land Registration (ANCPI) program 2015-2023. Registration is carried out exclusively at the level of the administrative-territorial unit (U.A.T.), respectively commune, city, municipality or at the level of one or more cadastral sectors, depending on the contract concluded between the executor and the local municipality. The procedures and stages of carrying out systematic cadastre works are regulated by Law number 7/1996 on cadastre and real estate advertising and the Regulation of July 9, 2014, on approval, receipt and registration in the cadastre records and land register, as approved by the Order ANCPI number 700/2014. The financing of the program is made from three different sources: own revenues of the ANCPI in the amount of approximately 900 million euros, non-refundable external funds (European Union) in the amount of approximately 312 million euros, allocations from the budget of the units administrative-territorial through co-financing and is done free of charge for property owners.

Keywords: ANCPI (National Agency for Cadastre and Land Registration); systematic cadastre

Introduction

The model of the partner countries for the stages of implementing a land cadastre information system within the development and integration process in the European Union was extremely useful for the countries admitted to the EU, including Romania (Durán Boo, 2002 a, b; Kjellson, 2002; Mirón Pérez, 2002; Kjellson, 2002; Leu, 2012). Knowledge of the informational environment, the scientific argumentation of the informatization process of society, of the rural domain and not only, become major objectives in cadastre for
European countries (Cichocinski, 1999; Kjellson, 2002; Botnarenco and Popescul, 2013; Comparetti and Raimondi, 2019).

Even if in the EU there are two original cadastral system models, related to the land registry systems, a central European one, beyond the German ‘Grundbuch’ area, and a Latin one (Comparetti and Raimondi, 2019), the working method for creating a systematic cadastre sector respects certain methods and procedures that are generally universal, but which could have also a certain national specificity. In this work, a case study was proposed based on an area that belongs to the administrative-territorial unit of Avrig, in the area of the village of Bradu, in Sibiu County, located in the central area of Romania, in the southern part of the historical-geographical region of Transylvania. In the 19th century, in Transylvania, and also in the respective area, the first topographic maps and the first land registers were made to keep records of the lands and their owners (Leu, 2012; Badea, 2014).

In Romania, after the establishment of the communist regime (1945), a large part of the lands, including those in the Transylvania area, were forcibly taken from the owners by the communist regime and collectivized. The process intensified starting in 1965, when the land records with the old properties were no longer recognized, the agricultural lands being taken over by the Romanian communist state and organized in the form of agricultural production cooperatives, or state agricultural enterprises.

After the fall of the communist regime (December, 1989) and the establishment of the democratic regime, extensive action to restore property rights for Romanian citizens began. The same action took place in the area of Bradu, in Sibiu County, where people were taken into possession and property titles were offered to them. For a short period of time, property titles seemed to solve the property problem. It’s just that they proved ineffective when the owners wanted to sell the land on which they had title deeds, or wanted to peel off or stick land from several lots. For these actions, it was necessary to register each parcel on the property title in new land registers, and the position of the buildings was uncertain, not knowing the exact property limit (Leu, 2012).

Thus, in 2015, the decision was taken to carry out the systematic cadastre throughout the territory of Romania, an operation through which the parcels on the property title are entered in new land records. The new property limits must be well established by coordinates so that their positions are no longer uncertain. In order to simplify the introduction of the general cadastre throughout Romania, an Integrated System for Cadastre and Land Registration was created. This was named E-Terra, being the only system for property management in Romania (Oprea et al., 2013). Consequently, in Romania, systematic registration is realised in the Eterra electronic database starting with the year 2015, together with the establishment of the National Agency for Cadastre and Land Registration (ANCPI) program 2015-2023.

Registration is carried out exclusively at the level of the administrative-territorial unit (U.A.T.), respectively commune, city, municipality or at the level of one or more cadastral sectors, depending on the contract concluded between the executor and the local municipality. The procedures and stages of carrying out systematic cadastre works are regulated by Law number 7/1996 on cadastre and real estate advertising (ANCPI, 2022) and the Regulation of July 9, 2014, on approval, reception and registration in the cadastre records and land register, as approved by the Order ANCPI number 700/2014.

Once the National Agency for Cadastre and Land Registration program was established, the systematic registration of buildings on the territory of Romania was started. At the time of the start of the program, approximately 40,000,000 buildings were estimated, of which 8,000,000 buildings were in the urban environment (20% of the estimated total), and the remaining 32,000,000 buildings were in the urban environment rural (80% of the estimated total). Out of the estimated total of 40,000,000 buildings, 19,506,273 buildings have been registered up to now, with a total area of 3,638,427 hectares, meaning a percentage of 48.76%. At present, systematic registration works are underway in 2058 territorial administrative units representing an area of 5,079,180 hectares. The list of territorial administrative units at the national level includes 3181 units. A total of 134 territorial administrative units were registered, representing a percentage of 4.21%, and another 2058 territorial administrative units are in the works, representing a percentage of 64.69% (ANCPI, 2022). In order to carry out the systematic cadastre at the national level, each territorial
administrative unit was divided into cadastral sectors, which coincide with the lands created after 1989. From a cadastral point of view, the territorial administrative unit Avrig, where the case study related to this work was proposed, is divided in 195 cadastral sectors.

In the current case study, the stages that have been completed are highlighted, including how to collect data from the land, how to process data from the land, drawing up the plot plan, entering property data for each individual building and preparing annexes for submission them at the National Agency for Cadastre and Land Registration office.

**Materials and Methods**

**Study area**

The study area regarding the systematic registration of a cadastral sector is located 50 km from the center of Romania, more precisely in Sibiu County within the territorial administrative unit of Avrig, in the outskirts of the village of Bradu (Figure 1, left). The village of Bradu is located at 45°43'15'' North latitude and 24°19'44'' East longitude and at an altitude of 395 m above the level of the Black Sea.

![Figure 1. Location of the study area, respectively Bradu village (left), and the old map of the village (right)](image)

The village of Bradu is a rural settlement, which dates back to the 14th century under the name of Feneufoula in translation meaning 'village with fir trees' (in Romanin, 'satul cu brazi'). The town is also shown on the Josefina map drawn up in the 19th century, when Transylvania belonged to the Habsburg Empire, on map number 238 under the name of Girelsau, near the Olt River (Figure 1, right).

**Work methodology and workflow**

The creation of a systematic cadastre sector includes several main stages, described in previous works on the same subject in Romania (Gresita and Grigorie, 2017; Cîmpean and Begov Ungur, 2018; Begov Ungur, 2018; Borsan et al., 2021):

1. Collecting data from the field.
2. Field data processing.
3. Realization of the plot plan
4. Entering property data for each individual property.
5. Preparation of documents to be submitted to the office of National Agency for Cadastre and Land Registration (ANCPI).

The application of these procedures and work stages were carried out in sector 148 of the territorial administrative unit Avrig, marked in red on the map in Figure 2.
Results

Collecting data from the field
Data collection from the field is carried out with the help of U.A.V. technology, GNSS technology and the total station, depending on the area of interest and the existing details in the field.

Step 1: making the orthophotoplane
In the case of sector 148 of the Avrig locality, a flight was first made with the help of UAV technology. The UAV equipment used in the present case was the FAE Rebel 1960 fixed-wing drone (Figure 3, left). The flight was carried out at an altitude of 250 m above the ground and its duration was 40 minutes.

Step 2: Identifying the details and picking them up from the ground
After the photogrammetric flight was carried out to obtain the orthophoto plane (Figure 3, right), it was moved on to identifying the details that had to be collected with the help of GNSS technology and the total station. In this case, there was the situation of fences that materialize property boundaries and constructions (Figure 4, left), the rest of the details being visible on the orthophoto plan.
Figure 3. FAE Rebel 1960 fixed-wing drone (left), and identifying the details that had to be collected (right)

The Hi-Target V60 GNSS system and the Leica TS15 total station were used to collect the details (Figure 4).

Field data processing
Field data processing includes two important steps:

a) Processing of data collected with the help of U.A.V. technology for obtaining the orthophoto plane.
b) Processing the data collected with the help of GNSS technology and the total station and overlapping them with the orthophoto plane.

Processing of data collected with the help of U.A.V. technology for obtaining the orthophoto plane require to process the data collected with the help of U.A.V. After the flight, 400 aerial photographs were taken that had to be processed. Data processing was done with the help of “Agisoft PhotoScan Professional” software. In order to obtain the orthophoto plane, it was necessary the following steps:

- Entering frames in the Agisoft program.
- Introduction of ground control points measured using GNSS technology.
- Identifying the control points on the ground on the frames and adjusting their position.
Alignment and georeferencing of all photos resulting in the orthophoto plane.

For the stage entitled 'Processing the data collected with the help of GNSS technology and the total station and overlapping them with the orthophoto plane', after the measurements were carried out using GNSS technology and the total station, the points with the coordinates collected from the field were downloaded and reported and superimposed on the orthophoto plane. In sector 148, the details that had to be collected with the help of these technologies were in a small proportion (Figure 5), so the time for collecting data from the field was short.

Figure 5. The characteristics of sector 148, where the data were collected (a), and particularities of the built perimeters (b)
Realization of the plot plan
The basis of the creation of the new plot plan was the old cadastral plan with possession from the 90s and the centralizing tables that included all the plots in the entire cadastral sector with their surfaces from the property titles.

To begin with, it was very important that the surfaces were well defined. For this, all the surfaces in the property titles were checked with those in the centralizing tables, so that they have the same values. Then the surfaces from the centralizing tables were compared with the surfaces of the lands that have a well-defined geometry in the Eterra electronic database. Where there were differences between the area in the Eterra database and the centralizing table, it was decided that the real area for the creation of the new parcel plan should be the one measured, existing in the electronic database. Once the areas of the parcels were well defined, they were grouped according to the old parcelling and land use (Figure 6).

![Figure 6. After delimiting the areas of the parcels (a), they were grouped according to the old parcelling and use of the land (b)](image_url)

After the grouping of the parcels by area, it was moved on to parcelling. The parcelling was done with the help of the TopoLT program depending on the direction of their possession, depending on the surface area in the deed and the successive disposition (Figure 7).

![Figure 7. The parcelling using TopoLT program, depending on the direction of their possession, the surface area in the deed and the successive disposition](image_url)
The parcels were made in all areas of the cadastral sector so that in the end the parcel plan was obtained with all the parcels of the cadastral sector (Figure 8).

Figure 8. The final parcel plan with all the parcels of the cadastral sector

**Entering property data for each individual building**

After the plot plan was completed, the next step was the entry of property data for each individual building. This was done using the specialist program CadGen.

To begin with, all parcels in the cadastral sector were numbered with CadGen numbers; being the first cadastral sector within the scope of the Avrig territorial administrative unit, the numbering started from CadGen number 1. The numbering was done very simply, by calling the “NUMBERS” command = insert CadGen numbers, after which all the buildings in the parcel plan were selected and indicated the numbering direction (from West to East) (Figure 9).
The next step was the entry of data for each property. To do this, the command "F21" = Add/Edit real estate data was used and, working in parallel with the open property titles, the data was entered for all the real estates in the cadastral sector (Figure 9). The entered data referred to: the address of the land; the measured area of the plot; the category of use; the number of the property title; the number of the plot; data on the owners (address, ID number) and how they acquired the property.

For the introduction of these data, the property titles were the basis of the registration of the property right in the land register. However, there were cases in which certain plots were sold or donated by the owners.
on the property titles or cases in which the owners on the property titles died. In all these cases, the property data were entered based on the adjacent documents made available by the current owners and here we are talking about: inheritance certificates, partition deeds, sale-purchase contracts, donation contracts or court decisions.

A more special case was represented by the buildings that were already registered in land registers through documents specific to the sporadic cadastre. For entering the property data related to these properties, things were simpler and the data was entered automatically by importing the CGXML files. These CGXML files were made available by the office of In Romania, systematic registration is realised in the Eterra electronic database starting with the year 2015, together with the establishment of the National Agency for Cadastre and Land Registration (ANCPI).

Preparation of documents to be submitted to the Office of Cadastre and Real Estate Advertising
After all the data for all the buildings in the cadastral register were entered, it was started to generate all the annexes necessary for systematic registration.

The first thing was the generation of all CGXML files by calling the command “F25” = Generate CGXML files, from the CadGen menu.

The second step was represented by calling the command “F22” = Generate cadastral annexes and successively the following were generated: the cadastral register of buildings, the alphabetical list of owners and the data sheets of buildings. After these were generated, they were printed in analogue format and together with the documents certifying the property were put in order.

After the documents in analogue format were prepared, the CGXML files were imported into the Eterra database (Figure 10) and the analogue documents were submitted to the National Agency for Cadastre and Land Registration office to be checked by specialized inspectors and to create the new land register.

Following the systematic cadastre of sector 148, within the Avrig administrative-territorial unit, 121 buildings were registered in the Eterra database, from which approximately 250 people benefited.

The area subject to the systematic registration works of sector 148 according to the model presented above was 493773 sqm, meaning a percentage of 0.29% of the total area related to U.A.T. Avrig.
Discussion

A unique cadastral model does not exist at the EU level. Each country applied the preferred model, and the “acquis communautaire” did not require any reform. Some recent reforms in cadastral registration systems have been carried out independently in some countries, in order to satisfy specific or particular objectives and needs of own land and socio-economic conditions (Comparetti and Raimondi, 2019). Some EU States, including Romania from 2007, implemented, developed, and update their cadastre procedures in order to (Comparetti and Raimondi, 2019): 1) establish a simple model based on territorial properties that generate income from public institutions, above all local governments; 2) to advance in the assignment and distribution of the real estate property, by facilitating the access of the occupiers to real estate (that under the previous model of the socialist economy were public properties) and building up a Land Registry; 3) to build up an authentic market of real estate, in order to promote the flow of capital and foreign investment in these countries.

In order to design a multifunctional cadastre system, an adequate understanding of the socio-cultural, land and judicial systems of each country is necessary (Williamson, 1986). Therefore, the integration of these systems with the set of appropriate institutional and organizational infrastructures is the key to sustainable sustainability and sustainability in any society (Enemark and Sevatdal, 1999; Oprea et al., 2011, 2014). Informational systems are modern and efficient land registration tools that facilitate the creation of multifunctional cadastral systems (Bogaerts and Zavenbargen, 2001; Çağdaş and Stubkjær, 2010). Such cadastre systems were implemented at the global level, under the particularities and jurisdiction of some national or state bodies (Golob and Liseč, 2022). They are efficient and can assure all the specific activities, throughout all their stages, starting from the making measurements and ending with the exploiting and maintenance of databases information (Oprea and Barb, 2019; Cienciała et al., 2021).

The development of the cadastral activity in Romania took place in several stages, the first starting according to historical circumstances since the nineteenth century, and reaching after 2004 in the stage of the integrated system of cadastre and land book (Badea and Badea, 2015). ETerra Information System developed by ANCPI (called “e-Terra”) ensure standardization of spatial data at the national level regarding land and buildings, generating a uniform and coherent database (Clinci et al., 2012, 2013). The e-Terra system was designed to manage property data, as a mandatory unitary system in Romania of technical, economic, and legal evidence. The system is of national importance, being used for all real estate across the country, and creating a real basis for the assessment, taxation and guarantees of property (Roib and Roib, 2014; Roib, 2019). The data are accessible online using Geographic Information System (GIS) technology, through NSDI geoportal (National Spatial Data Infrastructure), a component through which Romania contributes to the INSPIRE Directive (Infrastructure for Spatial Information in Europe) of the European Commission (Badea and Badea, 2013).

The realization of the systematic cadastre represents a very important step for the economic development of any society (Çağdaş and Stubkjær, 2010; Oprea et al., 2013; Golob and Liseč, 2022). The modern geospatial technologies may ensure regular verification and update of cadastral data and in this way economic benefits for local government units (Cienciała et al., 2021). Even if the verification of the numerous and continuous changes that appear in the planning of the territory, land management, data changes, etc. requires a permanent update and systematization in real estate management and land administration systems, not all member states of the United Nations Economic Commission for Europe are able to always keep such information up to date (Cienciała et al., 2021). From this perspective, a better situation appears in countries that have a unified system for collecting information on the distribution of land use and a complete census of data (including Romania). However, in Romania, the cases of updating the cadastral data are rare and, even if the data were updated by the owners, the positioning of the plots would be uncertain, because there is no plot plan. At the request of the beneficiaries, parcel plans can be made without carrying out systematic cadastre operations, so that the position of all parcels is well defined, but the costs for such parcel plans are high due to
the high volume of work required for their realization. However, the minus is brought by the fact that in certain administrative territories at the level of Romania, the situation of property documents is a precarious one and the executors avoid such problems. Due to this and the fact that at the beginning of the National Agency for Cadastre and Land Registration program the price offered for the execution of systematic registration works was very low (approximately half of the current price), the percentage of completion of the general cadastre is low compared to how was initially foreseen, and the expected completion target for the year 2023 is impossible to reach.

Conclusions

With the support of the three funding sources currently available in Romania, the systematic cadastre is the best option to bring all the cadastral data up to date and resolve all the uncertainties related to the positioning of the parcels. The executors of these works should carry out the systematic registration work at the highest quality standards without much effort, thanks to the modern technologies that have appeared in terrestrial measurements, represented by both software and hardware equipment. Currently, the use of U.A.V. standard technology that reproduces the precision required for cadastral works is the most optimal solution for the topographic survey. This could be the basis of the systematic cadastre because can assure a high yield and the collection of a large set of data in a short time. Also, specialized CadGen software offers a proper solution for inputting all property data with little effort.

Authors’ Contributions

Conceptualization (AH); Data curation (AH, AK, RP); Formal analysis (AH); Methodology (AH); Project administration (AH); Resources (AH, AK, RP); Supervision (AH); Visualization (AH, AK, RP); Writing - original draft (AH, EZ, AK, RP); Writing - review and editing (AH, EZ). All authors read and approved the final manuscript.

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The study was ... (DACA E CAZUL)

Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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