

Cadastral Involvement in Sustainable Development as an Essential Component

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Key words: cadastral data improvement, cadastral reform

SUMMARY

This paper is focused on the specific characteristics of the cadastral system in Croatia and reflects the interaction of the human society, economic development and natural environment in the process of land use and land marketing. Technology used in the cadastre is a basic tool for documenting the status of land and an input for land property regulation. A safe and responsible land market can only be ensured there, where land ownership is systematized, and this is achievable only if the cadastre is well organized and administrated.

In the fast growing post-war country's economy in the 1990's, the cadastre became one of the most important registers. An urgent and necessary improvement of the cadastre-based information began in 2003, when the State officiated a long-term project of reforming the land registers and the cadastre. The reform encompasses several operations which are described in this paper, illustrated by the example of the institutions involved in the process in the area of Koprivnica-Krizevci County.

The emphasis is on cadastral resurveys because only they provide a complete renewal of the cadastre and land registers. People obtain an accurate digital portrayal of what they own, the property line is defined, all buildings on a particularly part of the land are charted and the property is clear. The benefit is very quickly apparent, especially for those who are involved in buying, obtaining loans, selling, constructing buildings, protecting the area or in similar business operations. Compared with the inherited, inaccurate and analog cadastre, the achievements signal a true revolution.

The paper also deals with the development of the cadastre aimed at making it an equal peer entity in the process of sustainable development that provides a quick, secure and highly effective source of information. Given that today almost every piece of information contains a land component, it is necessary to have the cadastre involved in this process. The transformation of the state of the Croatian cadastre from poor to up-to date is now underway but this is not enough to satisfy the needs of the next generation. The development of the cadastre continues and the last part of the paper gives an overview of the latest meritorious efforts in this field made in Croatia.

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1. INTRODUCTION

Each state has its own rules and regulations about the land registration. Moreover, Croatia has inherited a specific dual registration system. The cadastre parties under the jurisdiction of the State Geodetic Administration in charge of documenting the status of the land (land use, location, shape and surface area) while the land registers are under the jurisdiction of municipal courts in charge of documenting the real property (owners and holders of other real property rights). Land, buildings and infrastructure are important assets of any country and are needed in almost all human activities. This is why the cadastre, one of the best-systematized land databases in Croatia, is a hot topic today. From the historical point of view, the cadastre system in Croatia was established in the 19th century through an expansion of the land surveying and land regulation systems of the Austro-Hungarian Empire. Due to the inappropriate political and systematic measures implemented during the past 50 or so years, the cadastre has not only stagnated in its development but has also been rendered deficient which, in turn, has led to its being uncoordinated with the *in situ* state of the land and the state of the land registers. Due to the afore-mentioned reasons, the cadastre was ill prepared to play a vital role in the booming land market of the 1990's. The cadastral data improvement started soon after the constitution of the new State and is still ongoing.

2. BASIC ROLES PUT IN PLACE

In the process of upgrading and improving the cadastral data, an essential role is played by the professional staff in the land administration sectors and their partners - financiers who have recognized the importance of the process. Many parties are involved, both from the public and the private sector, citizens, businesses, government and local and regional government units. The geodetic profession is well organized and diligent in carrying out its work.

2.1 State Geodetic Administration

The State Geodetic Administration is responsible for the legislation, licensing, geodetic network, State survey, mapping, cadastre, photogrammetry, quality control, special units and address registers, State boundaries and coordination of the National Spatial Data Infrastructure. The institution compiles annual and multiannual programs of the State survey and real estate cadastre, and takes care about the program execution. A significant part of the State Geodetic Administration's job is the promotion of the profession, collaboration with other partners such as the Croatian Geodetic Institute, Faculty of Geodesy, Ministry of Justice, Ministry of Agriculture, Fisheries and Rural Development and Ministry of Environmental Protection, Physical Planning and Construction as well as international cooperation.

2.1.1 Legal framework

The adoption of the Law on State Survey and Real Property Cadastre of 2007 has contributed to the cadastral improvement. Other related laws also provide a foundation for the development of the cadastre and for lobbying for a stronger political support. This especially refers to the Physical Planning and Construction Act and the Law on Agricultural Land passed in 2007 and 2008. The newly described business process in the land administration is also reflected in the amendments to the Law on Ownership and Other Real Rights as well as in the Land Registration Act passed in 2006 and 2007.

2.1.2 Organizational framework

The State Geodetic Administration is composed of the Central Office in Zagreb, twenty regional cadastral offices, one in each county, and one municipal office in the town of Zagreb. Every regional office has one to ten branch offices, so the total number of cadastral points of activity is 112. The organizational chart is shown in Figure 1.

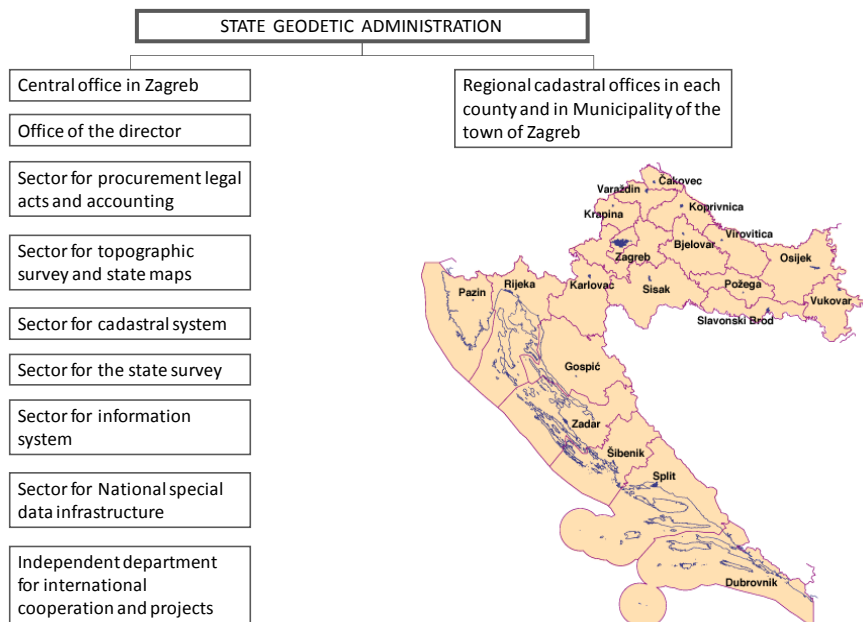


Figure 1. Organizational chart

Figure 2. Map of regional cadastral offices

2.2 Regional Cadastral Offices

The Croatian cadastre is one of the most organized records of spatial data in the country. One of the amazing things about the cadastre is its history. The more data is added, the bigger archives of information it becomes. The display unit in the cadastre is the cadastral parcel. Cadastral parcels are systematized in cadastral municipalities. The Republic of Croatia spreads over 56,542 square meters and has 4.48 millions inhabitants. The area is divided into 14.4 million cadastral plots and 3,357 cadastral municipalities displayed by 55,867 sheets of cadastral maps which are maintained at 21 cadastral offices.

2.2.1 Job description

Any changes of the parcel must be entered into the cadastral records database. Input, control registration, presentation of information and issuance of data from the cadastral database in the form of various documents is an everyday work of cadastre employees. The cadastre surveyors work primarily in an office, but their work also takes them into the field when they have to correct inherited errors in the graphical data, record changes in the type of land use or control the final output of private licensed surveyors – geodetic survey elaborate. Their services are invaluable for all the persons involved in any land activity.

2.2.2 Data structure

The situation of the land is recorded in the way of presenting the geometric description of the land (location, shape, area and buildings) for each cadastral plot on the cadastral maps and of systematizing the appropriate written information (owner, address, type of land use, purpose of building and special status on the land) on the possession registration sheets. Figure 3 shows the maintenance of the graphical data and the preparation of an official excerpt of the digital cadastral map. Figure 4 shows the maintenance of the written data and the preparation of an official excerpt from the possession registration sheet.

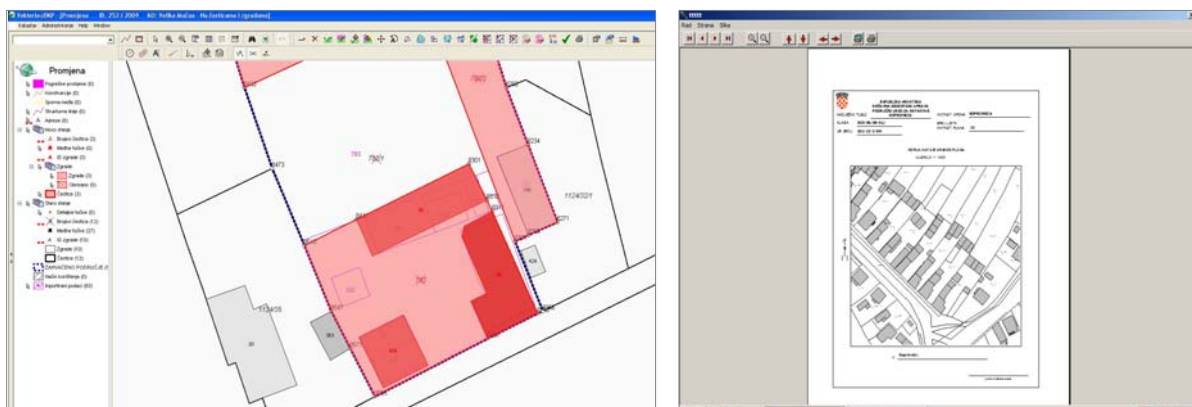


Figure 3. Maintaining and issuance of graphical data

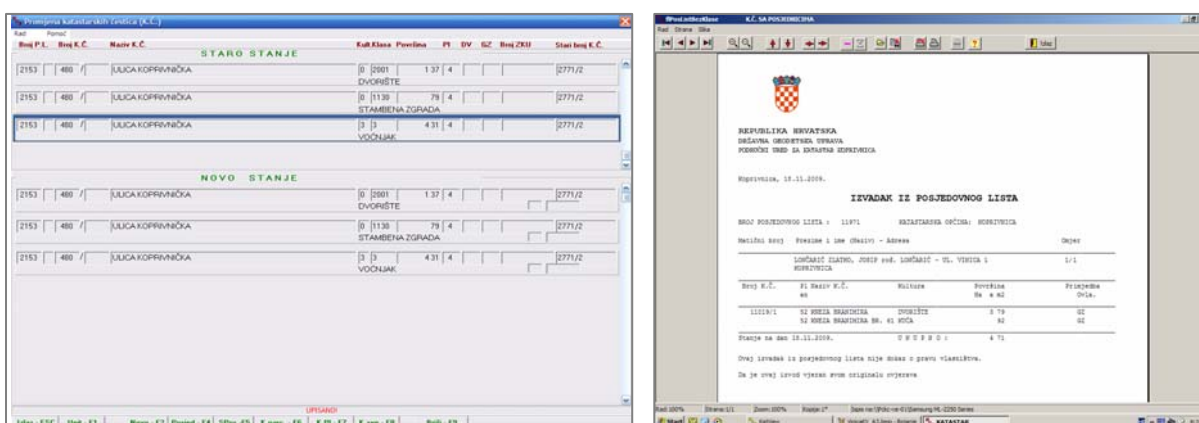


Figure 4. Maintaining and issuance of written data

According to the law, the buildings built without the required construction permit and usage license cannot be registered in the cadastre and land registers, and this represents a significant difference compared to the traditional concept.

2.2.3 Condition of the cadastral data

The cadastral office in Koprivnica, having authority over the Koprivnica-Krizevci county, shares the destiny of all cadastral offices in the Republic of Croatia. Lots of different laws, rules and regulations were enacted and different surveying methods were used in producing of cadastral maps at different times. The accuracy of cadastral maps depends on the combination of these circumstances. In the past few years, some of the cadastral maps have not been able to fulfill the demands that the cadastral system is being faced with and they have been replaced with new ones produced in the processes of resurveying. The periods of producing cadastral maps in the Koprivnica-Krizevci County are given in Figure 5.

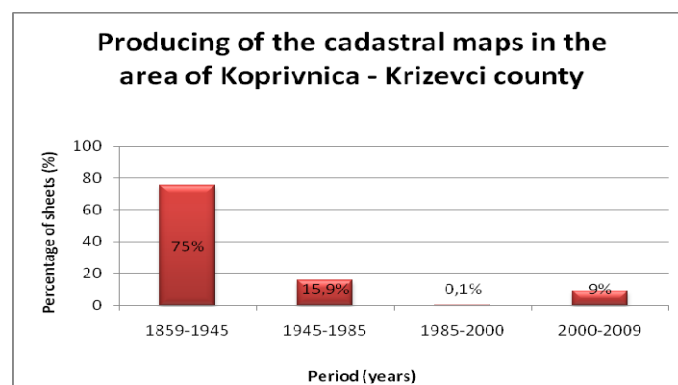


Figure 5. Producing of the cadastral maps in the county

The largest percentage of cadastral maps was generated by graphical methods in the period between 1859 and 1945. The worst examples of such maps, over one hundred years old, are shown in Figure 6. These maps have been in the everyday use until a few years ago and were among the first replaced with the new ones.

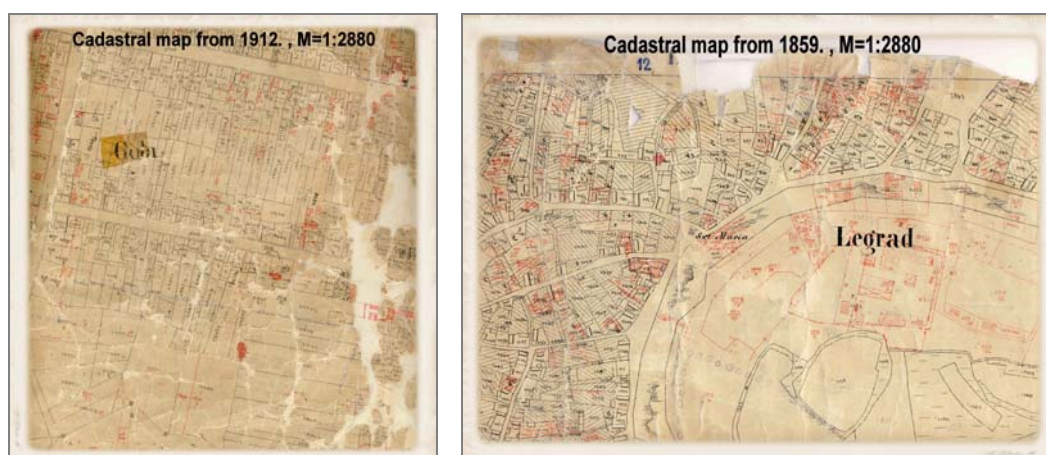


Figure 6. Examples of the old analog maps

A small number of cadastral maps for urban area were made by orthogonal and photogrammetric methods in the period between 1945 and 1985. The lowest percentage of maps has been produced by precise measurements as the results of the cadastral resurveys in the last nine years. The written cadastral data is the first set of the land administration public data in the Republic of Croatia that are fully digitized. These activities started in the early 1980's. The digitization of the graphical data has enabled the comparison of the graphical and written data which resulted in significant improvements of the existing data. Every individual error has been examined and the data has been corrected, except for the errors that cannot be corrected without the field surveying that is still in the process of being examined. The transformation of the graphical data into digital form is still ongoing but in many counties, as is the case with the Koprivnica-Krizevci County, the job was completed in 2009. The percentage of the digital graphical cadastral data distributed by regional cadastral offices in the area of the Republic of Croatia is shown in Figure 7.

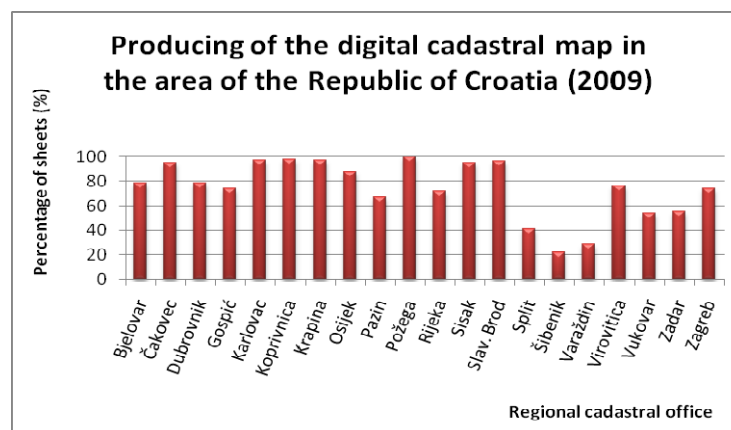


Figure 7. Production of the digital cadastral map in the country

2.3 Private Licensed Surveyors

In the Republic of Croatia, private licensed surveyors produce about 40,000 elaborates a year which also directly improves the cadastral data. Private licensed surveyors are authorized to survey private or public properties and to stake the boundaries of the area that is being surveyed. Usually, this concerns the subdivision of cadastral parcels or recording the buildings. Cadastral resurveys of an entire cadastral municipality or a large tract of agricultural land owned by the State are also performed by private licensed surveyors.

2.3.1 Job description

Whenever the land undergoes a certain change, such as a building activity, development, restructuring of the land, property sale or any other type of transaction, the surveyors are there first to determine the property location. They assist architects, land developers and engineers who also need to know what the land looks like so that they can correctly design new buildings and make correct urban plans. Most of their work is done outdoors. They travel to work sites and gather data (coordinates) from the field by using precise measuring tools and various surveying methods. They upload the data about land features such as shape, location

and elevation into a computer, analyze it, link it to other land descriptions and plot it out to make a final work product: geodetic survey elaborate or geodetic spatial dataset. Two parts of the elaborate are shown in Figure 8 and Figure 9.

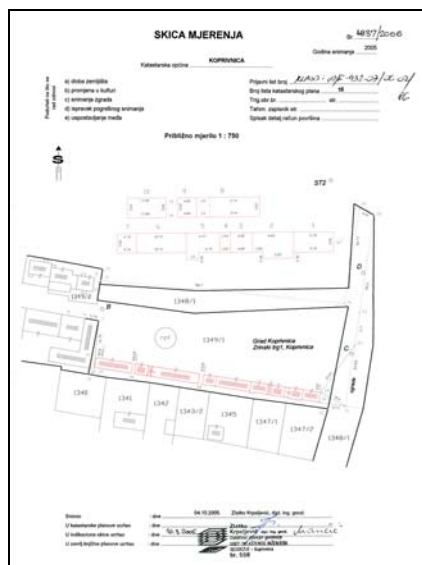


Figure 8. Draft survey



Figure 9. Main page of elaborate

2.3.2 Licensing

Since the private licensed surveyors perform the works of State survey and real estate cadastre, the State Geodetic Administration is responsible for their licensing and has established an inspection that controls the work of licensed firms. Private licensed surveyors are associated in the Chamber of Licensed Engineers of Geodesy. The first step to become a licensed surveyor is to be admitted to the Chamber. The right to join the Chamber has the person who cumulatively meets the following conditions:

- is fully capable for business and health
- resides in the Croatian territory
- has obtained a university degree
- has successfully completed the prescribed trainee procedure for 3 years
- has successfully qualified to perform professional surveying activities
- has no criminal record
- has not performed the activities which are incompatible with the profession.

Then, based on the Regulations on the Conditions and Criteria for being authorized to Conduct the State Survey and Cadastre passed in 2007, the person or company has to submit a request for authorization to the State Geodetic Administration. Part of the requirements is the decision about being admitted to the Chamber, a proof of own or leased equipment and a proof of own or leased office space, as prescribed by the Regulations. Natural persons have to enclose a copy of the official work track record while companies have to enclose an excerpt from the company register of the Commercial Court.

On 1/11/2009, there were 600 licensed surveyors and 531 companies or natural persons who had been authorized to conduct these activities in the Republic of Croatia.

2.3.3 Land registration procedures

The private licensed surveyors survey private land under the contract with the user. Cadastral surveys of entire cadastral municipalities or tracts of agricultural land owned by the State are performed under the contract with the State Geodetic Administration, county and municipality or regional government unit. The State co-finances this effort with 30 to 40%. When a cadastral parcel is physically changed, a private licensed surveyor is hired in order to develop the first product: geodetic survey elaborate. The technical accuracy of the elaborate is reviewed and confirmed by an authorized officer at the cadastral office and is then implemented in the cadastre. After completing the change in the cadastre, the reports have to be submitted to the land registers at the municipal court. A reverse process occurs when the change affects the owners or other holders of rights. It is first implemented in the land register and is then submitted to the cadastre. However, if a private licensed surveyor develops the second product – geodetic special dataset for the urban planner's designs, it will be reviewed and confirmed by an authorized officer at the cadastral office and forwarded to the designers. The procedure is shown in Figure 10.

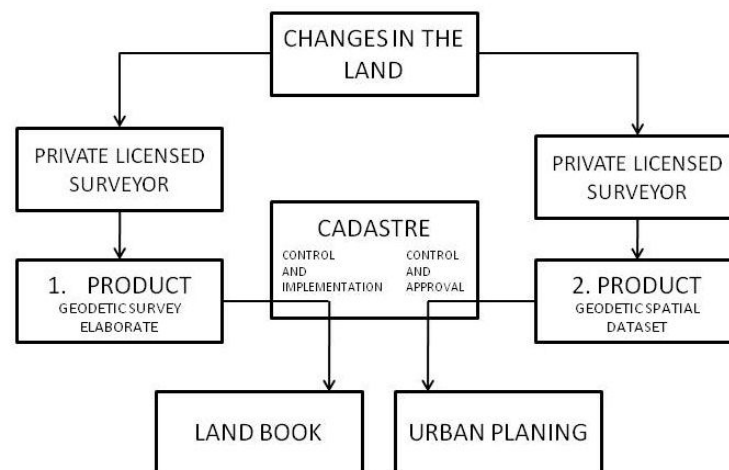


Figure 10. Procedures in registration of the land changes

3. THE REFORM

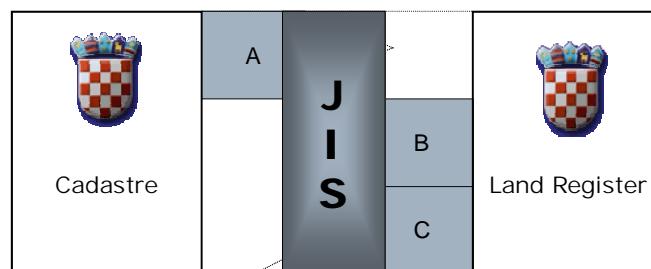
The cadastre development and expansion (if viewed through data, human resources, organization, and tools) began in 2003 with the Reform of the Land Register and the Cadastre. It is one of the major reforms undertaken in the last ten years in Croatia and has resulted in the status apparent today, but it is also the aftermath of many years of work done prior to the reform. The World Bank and European Union funded the project and many partner States (Norway, Sweden, the Netherlands, Germany, United Kingdom, Austria, and United States) have participated in the process of the reform aimed at supporting the development of the land administration system. The project is based on the institutional cooperation between two leading organizations in the land administration sector: Land Registry and Cadastre.

3.1 Activities at the state level

Since 2003, the State Geodetic Administration and cadastral offices together with the Ministry of Justice, including municipal courts, have worked together in the Project in order to speed up and simplify the real estate registration and to increase the transparency and security of the real property transactions resulting in increased investments and the overall economic growth. Within the framework of the reform, the following operations are being undertaken:

- capacity building in the land administration making it capable of implementing the reform
- digitalization of the written data and paper-based cadastral maps,
- renewal of the cadastral and land register data through cadastral resurveys and technical reambullations
- public awareness campaign
- establishment of the Joint Information System and National Spatial Data Infrastructure.

The reform has reached the inception level of the Joint Information System (JIS) which is currently in the process of creation. It will be a unified system for managing, maintaining and providing all the data concerning property rights, parcel data and other technical data related to the real property. It will cancel any double proceedings in the land registries and cadastre, and enable each organization to perform only its part of the work related to the real property registration. Both systems will be consistent and will not overlap in the registration process.



- A – technical description of the cadastral parcel
- B – owner or holder of other rights
- C – encumbrance sheet

Figure 11. JIS Scheme

This will speed up the real property registration and ensure that the data about owners and parcels do not diverge. At the local and global levels, it is clearly visible that there is a need for easier access to spatial data and their integration and use, so JIS must be an integral part of the National Spatial Data Infrastructure. One has to be realistic and aware of the fact that these activities require a lot of time. Even after the system is built, we will still be facing a long and challenging road.

3.2 Activities at the local level

A number of afore-mentioned operations had been implemented before the reform itself began. Each cadastral office, in compliance with the specifics of its authority and the state of its database, and pending the support and understanding rendered by the local and regional government units, tried to assist as best as it could the efforts to improve the system as a

whole. The regional cadastral office in Koprivnica was among the first who made the step towards the development of the cadastral system and the implementation of the reform. Regional Cadastral Office in Koprivnica is among the first who made the step towards of development of the cadastral system and of implementation of the reform.

3.2.1 Collaboration with the Municipality

The town of Koprivnica is a significant regional center and, although it is a small town in terms of its area and population, it conducts many activities. The municipality of Koprivnica includes several peri-urban areas where the construction zone is nearly merged with the construction zone of the town of Koprivnica, and the life follows the urban rhythm of the town. It is situated in the Koprivnica-krizevci County. The area of the county spreading over 178,000 hectares is divided into 650,000 cadastral parcels and 122 cadastral municipalities. and there are 110,000 people registered in the possession registration sheets. The area of the Municipality of Koprivnica inside the County is shown in Figure 11.



Figure 12. The area of the Municipality of Koprivnica inside the County

The municipal authorities were among the first recognizing the interest in investing in the cadastre and were aware of the fact that, without a modern land administration, faster information flow and more land transactions, there is no development of the town. They were very involved in the project of the cadastral data digitalization and the GIS which started in 1997 when many others still did not know how to produce digital cadastral maps and what the acronym GIS stood for. Today, the digitization of paper-based cadastral maps is one of the most important activities organized by the State Geodetic Administration and the National Spatial Data Infrastructure has become our reality. The job is mostly performed by private geodetic firms and many technical instructions and standards are laid down. It is almost a routine work. We can say when we started the project, it was a pioneering work. Anyhow, the GIS with its digital cadastral maps database for the area of the Municipality of Koprivnica has been established and applied since 2000. The users of the GIS for the town of Koprivnica are the municipality, county, utility and electricity power companies. Thanks to that project, cadastre in Koprivnica was among the first cadastres equipped with modern technologies.

3.2.1 Collaboration with the County

The awareness of the need for cadastral resurveys has not developed at the same pace in all parts of the Republic of Croatia because every cadastre has its own heritage. We also started among the first to conduct cadastral resurveys in the areas – cadastral municipalities where the cadastral resurvey was the only solution to improve the data. The completed cadastral resurveys, which have been implemented in seven cadastral municipalities in the last nine years, encompass only 9 % of the area of the Koprivnica-Krizevci County, but the importance and impact of the work performed means much more than the percentage expressed. Cadastral resurveys are long, painstaking and expensive processes but are inevitable and, therefore, cost-effective, especially in the places with a very active land market. If each individual tried to bring in order his/her land and property, it would be a much more complicated and expensive process. Schedule 1 provides clear indicators of the benefits. After the resurveys, the number of cadastral parcel and the fragmentation of the land were reduced but the number of registered buildings and the security in land transactions increased.

Cadastral municipality	Area (ha)	The number of cadastral plots before resurveying	The number of cadastral plots after resurveying	The number of recorded buildings before resurveying	The number of recorded buildings after resurveying
Podravske Sesvete	3231	9007	5603	507	2203
Jagnjedovec-grad	1373	5953	3053	940	2600
Legrad	3332	9813	5350	765	2367
Gola	1965	6459	3566	820	2820
Reka	1826	5251	2540	971	1921
Kunovec Breg	474	4067	2500	762	1510
Bakovčica	108	612	300	153	440

Schedule 1. The indicators about situation before and after resurveys

3.3 Cadastral resurveys as a part of the Reform

Usually the cadastral resurvey is conducted in the area where over 30 % of the data is inconsistent. The areas in the Koprivnica-Krizevci County where cadastral resurveys were conducted exceeded this percentage. The supervision of the projects is performed by the State Geodetic Administration and regional cadastral offices.

3.3.1 Course of Implementation

In accordance with the Law on State Survey and Real Property Cadastre, the course of implementation of cadastral resurveys throughout the Republic of Croatia is the same:

- public tenders for private licensed geodetic companies and signing of an agreement with the clearly defined interests and responsibilities (financiers: SGA, municipalities, counties, etc.)
- the Ministry of Justice necessary the approval and officially announces the beginning of the cadastral resurvey in the Official Gazette
- informing the citizens about their obligations in the process in the form of meetings, radio and newspaper announcements
- establishing a new geodetic network for the geodetic survey of cadastral parcels
- staking; all land owners are obliged to stake out the boundaries of their property

- geodetic survey and collecting other land descriptions and data about the owners
- production of digital cadastral maps and orthophotos
- drafting of geodetic elaborate with technical report about resurvey process
- public review and court procedure
- establishing the new cadastral documentation and a new land book

There are complains about the high cost of performing the work and about the long project duration but only this job results in the systematic cadastral and land book data renewal. The data obtained by resurveys reflects the actual property situation and thus obtaining the accurate records of the real property while the data in the Cadastre and Land Books is fully compliant. The difference in the data before and after the resurvey is evident when comparing the old cadastral map of the Drava River laid over the digital orthophoto map (Figure 12) with the new cadastral map with the same part of the Drava River laid over the digital orthophoto map (Figure 13).

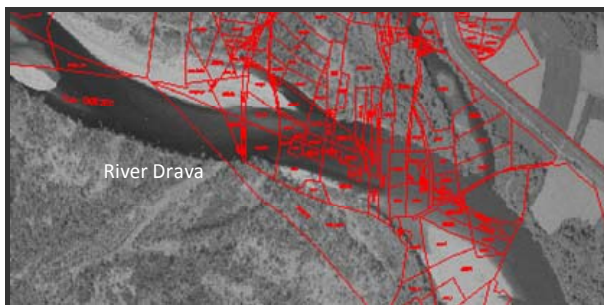


Figure 12. Old cadastral map in red color

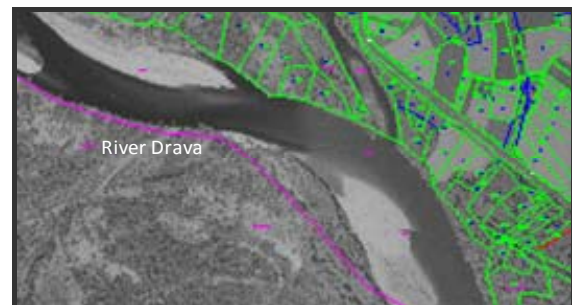


Figure 13. New cadastral map in green color

3.3.1 Needs Improvement

The experience gained in implementing the cadastral resurveys in the last ten years has shown the difficult but successful new directions to follow. A positive atmosphere has been created among the public and this should be supported and expanded. It has to be underlined that money is very important for the success but that the good regulations, motivation and political will of all participants are also very necessary. The systematic renewal of the cadastre and land books based on cadastral resurveys in the Republic of Croatia in the latest ten years:

- cadastral resurveys have finished in 76 cadastral municipalities where the new cadastral documentations and a new land books have been established
- cadastral resurveys are still pending in 77 cadastral municipalities
- cadastral resurveys have finished in 33 cadastral municipalities but establishment of the court commissions is still pending
- at 64 locations, the public review and court procedure is ongoing.

The experience gained in performing cadastral resurveys in about 250 cadastral municipalities has indicated that the following should be improved for a better success:

- current legislation and programs (re-arrange)
- marketing of land registers and cadastre, and developing the awareness among the users
- educate the citizens about the importance of the regulated ownership
- training of people who work in the commissions conducting public reviews and court procedures

- regulations for the public review and court procedure
- institutional cooperation of all the sectors involved
- motivation and political will of all participants for implementing the project
- synergy and expertise of all participants in implementing the project
- declaring property rights protected and guaranteed after resurveys and outlining the benefits.

4. SUSTAINABLE DEVELOPMENT

The basic premise of sustainable development is to do things differently. This process begins with a change of values of each individual and continues by transferring these into all other walks of life. However, balance must be maintained in this process between using, saving and restoring all our resources and understanding that the future generations will largely depend on our present activities. Due to the changes in our lifestyle, we become and will become increasingly dependent on the system that provides us with information, especially spatial information, in order to create the conditions for making correct decisions. It is a complex process of change that will go on for years and affect government authorities, organizations, private sectors, industry and all individuals. The cadastre is one of the major stakeholders of the spatial data so it is necessary to involve it in this process.

4.1 The impact of Cadastre

In a way, the function of the Cadastre, as the foundation of the functioning and efficient land administration, is to control and warn (loans, mortgages, sales and other land transactions) because it gives a clear definition of what is being transacted and where it is located. It is indispensable for the cadastre and the users to communicate on a daily basis. The presentation of the cadastral data to the users has to be achieved by means of the most advanced information technologies. By using cadastral data as a special type of information, the users achieve further improvements and generate revenues for their organizations which indirectly affects the entire society. The Cadastre is also the key for the geographic information system and it is important to support the attributes that make it multi-functional.

4.2 Users of cadastral data

Until recently, we would not consider many professions such as biologists, zoologist, climatologists, the people involved in the protection of the cultural and natural heritage etc. as the creators of the spatial information whereas now they significantly contribute the system in general. More than ever, there is a need to present the cadastral data in many sectors connected with land-use planning, physical planning, loan security, security for credits, monitoring and analyzing statistical data, development control, environmental impact assessment and environmental protection, emergency planning and management, land transaction and property taxation, building the geographic information system and National Spatial Data Infrastructure. These sectors are encompassed by the organizations such as State authorities, municipalities, agriculture, private enterprises, forestry, mapping and power supply companies as well as citizens. Since 12 % of the Republic of Croatia is considered a protected land territory and since Croatia holds the third place on biodiversity in Europe, it

has been observed that the decisions about the environmental and cultural heritage are being passed in a significantly different manner than was the case before. In the past, geographic or cadastral maps were never part of any decision on declaring the cultural good (for example, the remains of the city works, churches, chapels, old cemeteries or memorial areas). Today, a geographic or cadastral map is an essential part of this kind of decisions and the cultural good is recorded in the possession registration sheets.

4.3 Publicity of cadastral data

For the reform objectives, the customer service is a very important goal. The establishment of electronic services confirms the will to provide better and more efficient services to the citizens. The most important projects which the State Geodetic Administration has undertaken in this field is the establishment and maintaining of the metadata public services: www.katastar.hr, www.geo-portal.hr and www.cropos.hr. They ensure access to the written and graphical cadastral data and geodetic network data to all interested users on the Internet. All these browsers ensure a simple and easy access to the public. It is evident that they are very much used. The www.katastar.hr browser allows the free-of-charge insight into all written cadastral data for the whole State. On 1/12/2009, there were 26,097,000 inquires. The www.geo-portal.hr browser which contains digital cadastral maps, orthophotos and other topographical maps in digital format is also free of charge.

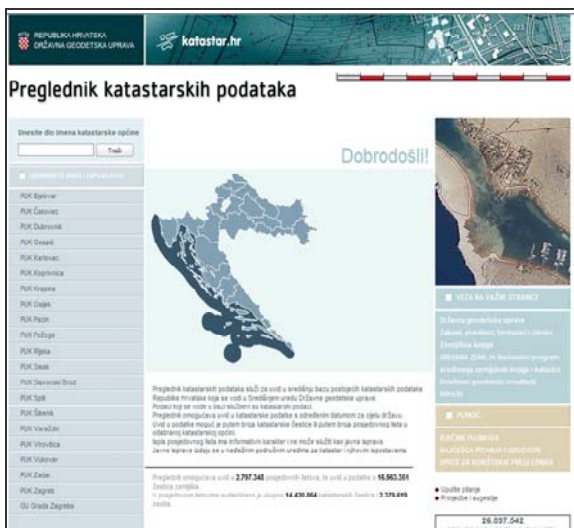


Figure 14. www.katastar.hr

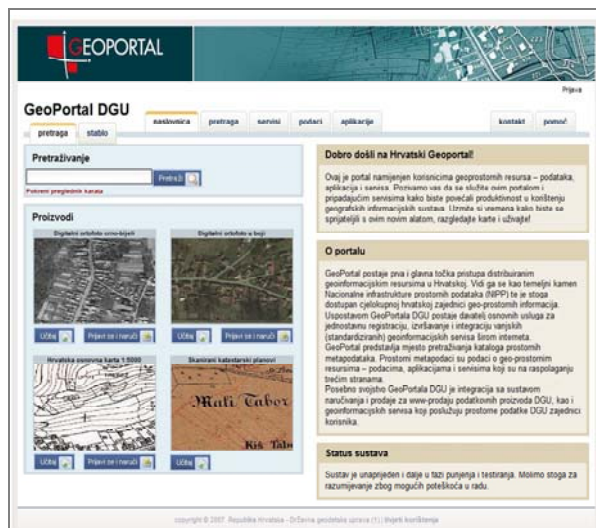


Figure 15. www.geo-portal.hr

CROPOS is the national network of GNSS reference stations. The purpose of the cropos.hr browser is to enable the point positioning in the real time in the entire country. The users have to register and pay for the service according to the Regulations on Determining the Actual Costs of Using the State Survey and Real Estate Cadastre Data. The major benefits for the customers using the on-line digital cadastral data as opposed to the paper-based records are obvious and attractive. They include improving the timeliness and speed of the service, improving convenience through extended hours of availability, improving the applicability, flexibility and efficiency as well as searching the data for the entire State at home.

5. CONCLUSION

The background of this paper is the cadastre because it is faced with rapid technological and political challenges. The transformation of the Croatian cadastre from containing no digital data into the cadastre based on a highly productive computer system, where one can reach any piece of data at a click of the mouse, is ongoing but we need more. We have to be able to promptly and efficiently address future challenges and contribute to the competitiveness of the Croatian economy and its attractiveness for the foreign as well as local investors. Therefore, we make continuous efforts to establish the strong and effective land administration. The new strategy yielded many good effects such as the full employment of surveyors, well-equipped geodetic firms, attractive study of geodesy and content cadastral employees. The comparison with the countries that have taken care of their spatial data for centuries is here inappropriate. Our path was different and thorny because of the discontinuity of 50 years when no one was taking care about the private property and land registers. Sustainable development, involving a modern and global philosophy of the natural resources management, continuously requires a lot of relevant and actual spatial data and geo-information and a modern, complete and multipurpose cadastre can assist the efforts for its creation.

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BIOGRAPHICAL NOTES

Jelena Unger was born in Koprivnica on April 2, 1965. She graduated from the Faculty of Geodesy of the University in Zagreb. In January 1990, she started working for the Podravka company, performing surveys of agricultural parcels owned by the company and in late 1990 she moved on and started to work for the cadastre. Since 1995, she has been working as the head of the office that later became the Regional Cadastral Office of Koprivnica. She has participated in many national and international conferences and her lectures concerned the establishment of the geo-information system and the development of the cadastre and the overall land administration. Areas of interest: GIS, cadaster, ecology, geography, cartography

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1984-1989 Graduate engineer, University of Zagreb, Faculty of Geodesy

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January 1990 - Podravka - Food factory, surveying division

December 1990 - Koprivnica-Krizevci county, Cadastre office, advisor

May 1995 - Koprivnica-Krizevci County, Cadastre office, head of office

May 2000 - State Geodetic Administration, Regional Cadastral Office in Koprivnica, head of office

Memberships:

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Warsaw, Poland GIS Polonia, Geographical Information Systems International Conference, 15 - 17.10.2001. (author, theme: Cadastre in the Project Gis for the Town of Koprivnca)

Zagreb, Croatia Second Croatian Congress about Cadastre, 24 - 26.10.2001. (co author, theme: The Role of Cadastre in the Developing of GIS)

Split, Croatia Gis Odyssey 2002, Geographical Information Systems International Conference, 2 - 6.9.2002. (co author, theme: Four Years of Running GIS in

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- Zagreb, Croatia Third Croatian Congress about Cadastre, 7 - 9.3.2004.(co author, theme: The Cadastres Role in Geodesy)
- Opatija, Croatia Gis Odyssey 2005, Geographical Information Systems International Conference, 5 - 9.9.2005. (co author, theme: Developing of Cadastre in the latest ten years)
- Sibenik, Croatia Gis Odyssey 2006, Geographical Information Systems International Conference, 3 - 7.9.2006. (co author, theme: Efficient GIS Solutions)
- Opatija, Croatia Regional Conference on Cadastre and Land Administration, 8 - 10.6.2008. - participant
- Becici, Montenegro Impact of EU Legislation on Cadastral Operations, 20 – 22.10.2008. - participant
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