Public-Private Partnerships in Land Administration

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Key words: public-private partnerships, geodesy, cadastre

SUMMARY

In land administration, public-private partnership is a common form of cooperation used to create and keep land or building records, along with their maintenance. In the Republic of Croatia, public-private partnerships were introduced when Croatia became independent, as almost every company had previously been owned by the former country – the Socialist Federal Republic of Yugoslavia.

With the independence of the Republic of Croatia in 1991, many state-owned enterprises became private companies, including the companies involved in geodetic and cadastral services.

At the beginning of the 21st century, private geodetic practice in various fields was on the rise, especially the services related to cadastre, which resulted in a significant increase of small companies. In addition to the Basic Act on State Survey and Real Property Cadastre, the legal regulation was further strengthened by the Act on Geodetic Activity and the association of chartered engineers of geodesy to the Croatian Chamber of Chartered Geodetic Engineers.

This paper thoroughly investigates and analyses the activities of public-private partnerships in the geodetic field and provides insight of their impact on the geodetic profession and daily life of entrepreneurs and other citizens.

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1. INTRODUCTION

Governments around the world, but especially in Europe, have increasingly used private sector involvement in developing, financing and providing different kinds of infrastructure and service delivery through public–private partnerships (PPP). Reasons for this uptake are manifold ranging from rising expenditures for refurbishing, maintaining and operating public assets, and increasing constraints on government budgets stifle, seeking innovation through private sector acumen and aiming for better risk management (Roehrich et al. 2014).
The main tasks and services of public-private partnerships in Croatian geodesy, since the independence of the Republic of Croatia, have been in the domain of official state cartography and new cadastral surveys necessary in the real property cadastre development. This cadastre contributes to legal security in real property transactions, and simplifies property registration and renewal of land registry.

The implementation of cadastral surveys uses the model of public-private partnership in which the national or local governments are the contracting authorities and investors, while the part of work related to the presentation of data collected in cadastral surveys, as well as the establishment of new records, is performed by the cadastre, a part of the State Geodetic Administration, and the municipal courts, a part of the Ministry of Justice.
Many other geodetic tasks, such as engineering geodesy, cyclical surveys for various cartographic displays, and the development of geo-information systems at local, regional and state levels, are often based on the public-private partnership model where the state administration body only has the role of a contracting authority.

Cadastral data are basic data for land administration systems. Their availability in a digital form makes them interesting for the increasing number of new areas of human activity and is essential for their further development, which has led to a constant increase in demand for cadastral information. Therefore, countries have to work on improving the information flow by collecting and maintaining 2D, 3D and 4D cadastral data to keep up with the growing requirements, especially those related to efficient land administration (Vučić et al. 2017).

The paper is organized as follows. The first section (Introduction) overviews the public–private partnership in land administration. The second section deals with the main tasks of the Croatian State Geodetic Administration, while the third section describes official state cartography. The fourth section focuses on the new real property cadastre. The fifth section describes other activities of PPP in geodesy. The paper ends with the conclusion.

2. STATE GEODETIC ADMINISTRATION

The State Geodetic Administration (SGA) is a public authority performing administrative and expert tasks in the fields of geodesy, cartography, cadastre and photogrammetry, digitisation of cadastre and geodetic-spatial system, official state mapping, geodetic documentation, statistical data about real property cadastre, spatial units and utilities, geodetic-cadastral activities related to the state border, and is concerned with the establishment of a national spatial data infrastructure. National Spatial Data Infrastructure (NSDI) is defined as a set of technologies, measures, standards, implementation rules, services, human resources and other factors enabling the efficient integration, management and maintenance of the sharing of spatial data for the purpose of meeting national and European-level needs, which will be an integral part of the European Spatial Data Infrastructure defined by the INSPIRE Directive (URL 2).

The Croatian State Geodetic Administration Geoportal is the central place to access spatial data and one of the basic elements of NSDI. The SGA Geoportal represents one of the cornerstones of National Spatial Data Infrastructure, disseminating spatial datasets under the jurisdiction of the SGA.

In the 2013-2015 period, the Croatian State Geodetic Administration implemented the EU financed project "Support to the Establishment of the Components of the Integrated Land Administration System (ILAS) in the State Geodetic Administration - Instrument for Pre-Accession Assistance for Croatia – IPA 2010". In the course of this project, an upgraded Croatian SGA Geoportal was developed (Figure 1).

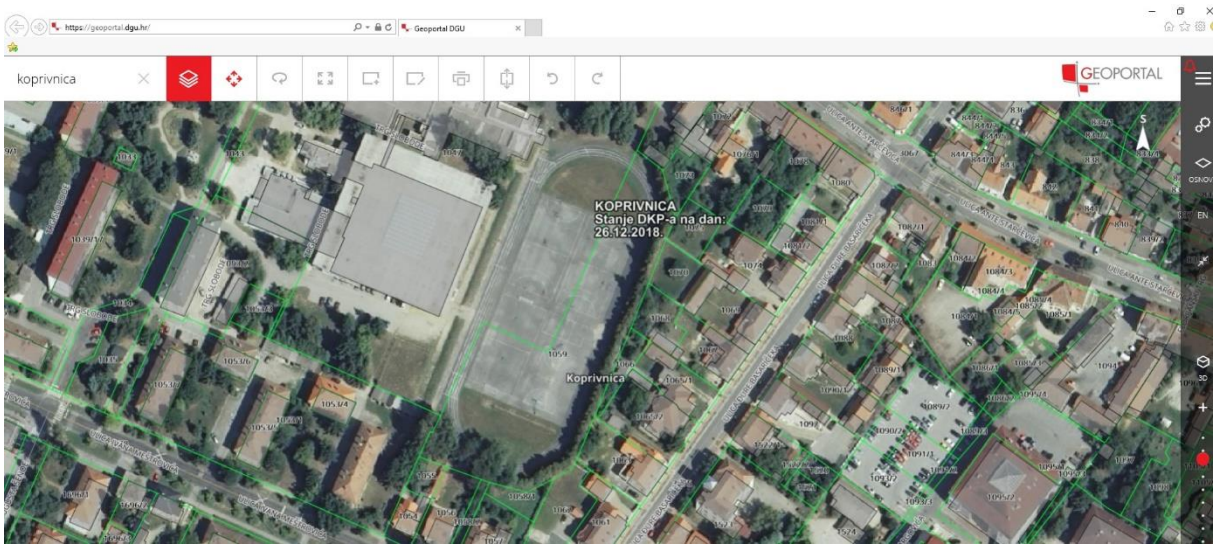

Figure 1. Croatian SGA Geoportal

Croatia has a specific, inherited dual registration system – the cadastre, as a part of the SGA, for documenting the status of land (type of use, location, shape and surface area), and the land registry, as a part of municipal courts, for documenting real property ownership (owners and

holders of other real property rights). Although these are two separate registers in Croatia, the cadastre under the jurisdiction of the State Geodetic Administration, and the land registry under the jurisdiction of the Ministry of Justice, they are linked by means of the Real Property Registration and Cadastre Joint Information System (JIS) established at the level of the whole country.
The JIS was developed on the public-private partnership basis, where the State Geodetic Administration and the Ministry of Justice had the role of contracting authorities.
It is a unified system for managing, maintaining and providing all data concerning property rights, parcel data and other technical data related to real property. There are no double proceedings in the land registries and cadastre, which enables each organisation to perform only its part of the work related to real property registration. As of 2015, the JIS was established throughout the country, in every cadastral office (112 locations) and every land registry office (107 locations).

Other activities by the State Geodetic Administration based on the public-private partnership model related to improving data and services are:

- Cadastral map homogenization – technical procedure for geometric improvement of cadastral parcels in graphical survey;
- Digital Geodetic Elaborate System – applicative solution that provides full support to licensed surveyors in preparing the Digital Geodetic Elaborate (DGE);
- Utility Cadastre – special state record containing the location and other necessary information nationwide about all types of infrastructure.

3. OFFICIAL STATE CARTOGRAPHY

3.1 Base state maps

By the end of 1990, when the separation of the Republic of Croatia from the former Socialist Federal Republic of Yugoslavia began, Croatian institutions that had 50 to 70 employees existed and started their conversion into joint stock companies.
Such companies had experience in producing the Croatian base map on a scale of 1:5000 but no experience in making topographic maps on other scales. At that time, digital production of topographic maps had not yet been developed in more developed European countries (Vilus 2018).

With the realization of a project of making a topographic map on a scale of 1: 25,000, significant development of Croatian cartography started. The public-private partnership in this project is highly present – the state (Republic of Croatia) is the sponsor and the contracting party, while private geodetic and cartographic companies are product manufacturers.

3.2 Topographic maps

The following topographic maps are in official use in Croatia: 1:25,000, 1:100,000 and 1:200,000. The basic source for making TK25 is aero-photogrammetric imaging, topographic data and digital relief model. TK25 is produced according to corresponding product specifications. The main groups of facilities shown in TK25 are permanent points of geodetic bases, constructions and other structures, pipelines and facilities connected with waterways, roads and objects related to traffic, vegetation and types of land, water and water-related facilities, elevation terrain and relief forms, state border, box and map description with coordinate network and geographic names. All topographic data on TK25 are presented with the same importance and with a certain degree of generalization. In the period from 1996 to 2010, TK25 was produced in the 5th and 6th Gauss-Krüger mapping projections at Bessel's ellipsoid in 1841. Since 2011, TK25 has been produced in a new partition on sheets, and in the new cartographic projection HTRS96/TM on the ellipsoid GRS80 (changed the orientation of the list). Up to 2017, 68% of all TK25 sheets were updated in the new format. TK25 is used in spatial planning, conceptual planning and design of infrastructure facilities, professional use in public and private management, planning and maintenance, rescue operations for tourist and recreational activities etc.

The topographic map (TK100) is an official state map drawn on a scale of 1:100,000. The official state map is a coded picture of natural and constructed objects of land that is being developed for the entire territory of the Republic of Croatia. The topographic map on a scale of 1:100,000 was made in the period from 1980 to 1984. The entire territory of the Republic of Croatia is covered with 55 sheets.
The topographic map (TK200) is an official state map made on a scale of 1:200,000. The official state map is a coded picture of natural and constructed objects of land that is being developed for the entire territory of the Republic of Croatia. The topographic map on a scale of 1: 200,000 was made in the period from 1982 to 1986. The entire territory of the Republic of Croatia was covered with 18 sheets.

4. NEW REAL PROPERTY CADASTRE

In the independent Republic of Croatia, the State Geodetic Administration, the Government and the Parliament adopted several programs for new cadastral surveys, into which intensive efforts have been invested to develop a new real property cadastre.
Given the wartime events, there were fewer cadastral surveys in the 1991-2000 period. Following the adoption of the State Survey and Real Property Cadastre Act in late 1999, cadastral surveys were launched throughout Croatia. Since 2000, cadastral surveys have been carried out for 414 cadastral municipalities (Figure 2) as follows (status as of 3 October 2018):

- 195 cadastral municipalities have been put in use;
- 36 cadastral municipalities are in the process of cadastral survey being carried out;
- 12 cadastral municipalities are in the process of geodetic reports being reviewed;
- 89 cadastral municipalities have been reviewed and are in the process of waiting for public display;

- 82 cadastral municipalities are in the process of public display being carried out.

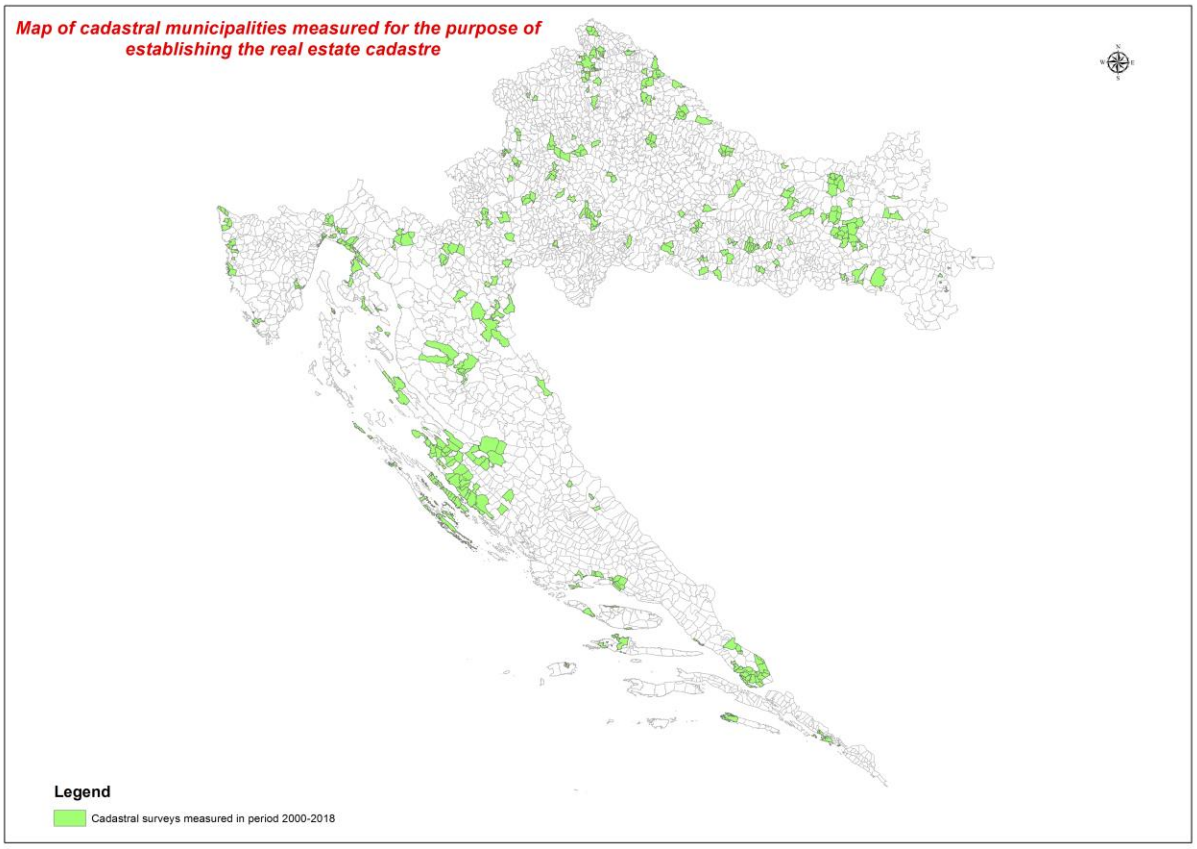

Figure 2. Cadastral surveys for establishing real property cadastre (2000-2018)

The total area covered by the cadastral surveys (Table 1) aimed at creating the real property cadastre is 441,612 hectares.

Table 1. Real property cadastre summary - status October 2018

Status of cadastral municipality	Number of cadastral municipalities	Area (ha)	Number of cadastral parcels
In official use	195	198,614	498,722
Public display	82	102,428	368,652
Waiting for public display	89	75,538	307,362
Geodetic report in review process	12	9,301	64,428
Cadastral survey process	36	55,731	134,889
TOTAL	**414**	**441,612**	**1,374,053**

The implementation of cadastral surveys uses the model of public-private partnership in which the national or local governments are the contracting authorities and investors, while the part of work related to the presentation of data collected in cadastral surveys, as well as the establishment of new records, is performed by the cadastre, a part of the State Geodetic Administration, and the municipal courts, a part of the Ministry of Justice. Between 1 March 2000 and October 2018, HRK 781,222,330 was spent on real property cadastre, corresponding to approximately EUR 105,570,585 (exchange rate EUR 1 = HRK 7.4). These funds are returned multiple times to the state, citizens, entrepreneurs, and units of local self-government, since a completely ordered situation in the cadastre and land registry reflects the actual situation in the field, which lasts for several centuries.

4.1. New cadastral survey procedure

When real properties (land parcels, cadastral parcels) registered in the cadastre and land registry do not correspond to the actual situation in the field, such a situation can be changed by means of an appropriate geodetic report. For historical reasons, this lack of harmonisation is present in large areas, and the State Geodetic Administration has launched a comprehensive program of organising the cadastre and its harmonisation with the actual situation in the field. This program is financed from the state budget, as well as county, city and municipality budgets. Furthermore, legal and physical persons who are real property title holders can also provide financial resources. Cadastral surveys makes the basis for this program.
A cadastral survey means gathering and processing of all necessary data in order to form cadastral parcels, record buildings and other structures, record special legal status of the land and land use, including the creation of cadastral documentation of the real property cadastre.

The State Geodetic Administration, in agreement with the Ministry of Justice, conducts the cadastral survey for a cadastral municipality or a part of it, and specific works within the cadastral survey are conducted by licensed private geodetic companies. Licensed geodetic companies are selected at public tenders. Since the cadastral survey is conducted for a specific area, all persons affected by the survey on that area must be notified about it. As stipulated by the law, a decision on the cadastral survey is passed by the Director-General of the State Geodetic Administration, and such decision must be published in the Official Gazette. Along with the above-mentioned, the information on the cadastral survey implementation is also published in the local media (newspapers, radio). All local government units where surveys are conducted organize public meetings for citizens where the survey procedure is explained and instructions given regarding the marking of land borders with visible and permanent (boundary) markers. Along the roads passing through the area under surveying, boards are placed which mark the worksite.

When the cadastral survey is conducted in a cadastral municipality, the land title holders are obliged to mark, using visible permanent markers, the borders of the land they own, hold other rights or manage, at their expense and within the time period stipulated by the decision on the cadastral survey. The title holders receive a written notification on the delineation. The title holders are provided with professional assistance, free of charge, in the delineation process. The delineation is conducted for all breakpoints of a cadastral parcel, and depending on the type of

terrain, can be conducted with a concrete pillar, iron wedge, ceramic pipe, plastic marker with an iron core, or by carving a cross in a solid rock. Those cadastral parcel breakpoints that are clearly recognisable in the field, such as fences, houses, etc., need not be specifically marked.

When all of the necessary data are collected and processed in a cadastral survey, a cadastral survey report is produced. Along with all other parts, the cadastral survey report must include a cadastral map and evidential sheets. The cadastral map shows cadastral parcels with their boundaries, as well as the buildings constructed on them and the numbers of cadastral parcels (Figure 3). The cadastral map also shows the house numbers and borders of different land uses on the cadastral parcel. The evidential sheets show all of the collected and processed written data on the cadastral parcel, data on the real property title holders collected on the basis of available documents (land registers and cadastre), as well as the statement of interested parties.

Figure 3. New cadastral survey (cadastral municipality Skenderovci), source: URL 1

4.2. Result of the new cadastral survey

The result of a cadastral survey is a completely ordered situation in the cadastre and land registry which reflects the actual situation in the field. Citizens get an accurate digital portrayal of what they own, the property line is defined, all buildings are charted on the particular part of land and property is clear. Benefits are very quickly apparent, especially for those who are involved in buying, getting a loan, selling, constructing buildings, protecting the area or in similar businesses. After the survey, fragmentation of the land (the number of cadastral parcels) is usually reduced by half, and the number of recorded buildings usually increases three times (Table 2).

Table 2. Results of cadastral surveys in the Koprivničko-križevačka County

CADASTRAL MUNICIPALITY	AREA (ha)	The number of cadastral parcels before resurveying	The number of cadastral parcels 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

After the survey, there is a single database of cadastral and land registry data that is kept together from then on. Security in land transaction is highly increased (Figure 4).

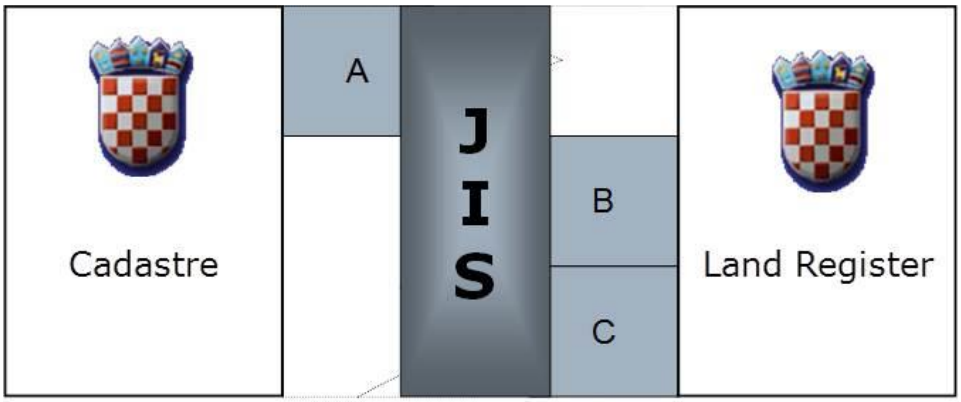

Figure 4. Scheme of the Real Property Registration and Cadastre Joint Information System (JIS)

The scheme shows sheets A, B and C that represent:

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

The JIS speeds up the real property registration and ensures that 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 the JIS must be an integral part of National Spatial Data Infrastructure.

5. OTHER ACTIVITIES OF PPP IN GEODESY

Numerous other projects are performed at the State Geodetic Administration through PPP.

5.1. SGA Geoportal

The upgraded Geoportal is based on the same underlying technology platform as the previous one, but it was completely rebuilt with added new complex functionalities, new data services and a completely new design. One of the biggest changes from the earlier version of the Geoportal is the inclusion of user registration with several different user types. Depending on the user type, different functionalities and services are available. Major attention was paid to the access security model and refinement of the SGA Geoportal Metadata subsystem. Data dissemination was implemented through the use of standard OGC services (WMS, WMTS, WFS and WCS) thus allowing their use in other systems as well. An integrated web viewer provides direct access to spatial datasets for the general public, while reuse of web services will greatly facilitate the adoption of spatial data in other institutions and organizations.

In addition, migration of alphanumerical database into the new GIS system was done in this project. Around 1,600,000 house numbers and buildings spatially recorded were migrated from the previous to the new system. Business and graphical web services were developed, allowing easier access to addresses and organizational spatial units of the Republic of Croatia through the SGA Geoportal.

By changing the scale of topographic and cadastral maps with selecting different maps on SGA Geoportal (1:5000, 1:25,000, 1:100,000, 1:200,000) or cadastral maps (from 1:1000 to 1:5000) we have access to 2D and 3D real-life situations that are already registered in the land administration system.

5.2. Cadastral map homogenisation

Seen from the historical point of view, the cadastral 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. The largest percentage of generated cadastral maps was by graphical methods in the period between 1869 and 1916, and they are still in everyday use. An improvement of these old cadastral maps is necessary. The best way to do so is cadastral map homogenisation – a technical procedure for geometric improvement of cadastral parcels in graphical survey, which takes care not to break the best parts of the digital cadastral map.

This technical action does not change the legal status of graphical cadastral data and cannot substitute the cadastral survey, but will make possible to draw changes based on the measured individual geodetic surveys in the official records by the overlapping method and properly represent the actual position on the field (Moharić et al. 2018).

5.3. Digital Geodetic Elaborate System

The Digital Geodetic Elaborate System (SDGE) is a comprehensive applicative solution developed in modern web technologies, in accordance with the principles of interoperability and openness, that provides full support to licensed surveyors in preparing the Digital Geodetic Elaborate (DGE), following the entire process of downloading initial state data in digital GML format, preparation and development of geodetic data in digital form to submit the geodetic report to the relevant cadastral office for review and confirmation electronically. The SDGE is an advanced solution associated with the Real Property Registration and Cadastre Joint Information System (JIS) and One the Stop Shop (OSS) system (URL 2).

The graphical part of the digital geodetic elaborate (DGE) is made in accordance with technical specifications for the creation of digital cadastral maps and the graphical part of digital geodetic elaborate, as well as technical specifications for geodetic elaborates. It consists of a survey draft, and in case of non-homogenous cadastral maps, of a cadastral map for the maintenance of digital cadastral maps. The Digital Geodetic Elaborate System has a number of implemented automated controls that ensure integrity and validity of the graphical part of DGE (Tomić et al. 2018).

The SDGE provides support to geodetic surveyors in creating and checking digital geodetic elaborates. The SDGE is connected to external systems by web services that provide data, official documents, and processes in the creation of DGEs. Interoperability and attainability of the SDGE system also refer to the SDGE REST API module that enables external systems via web services to use SDGE functionalities, such as quality control and data conversion (Grđan et al. 2018).

5.4. Utility cadastre

Utility cadastre is defined by the State Survey and Real Property Cadastre Act in the Republic of Croatia. The State Geodetic Administration is responsible for the establishment and maintenance of utility cadastre (State Survey and Real Property Cadastre Act, Official Gazette no. 112/2018). In the previous period, from 2000 till 2018, utility cadastre registers were under the jurisdiction of local governments (cities and municipalities) and did not have any positive effect because cities and municipalities did not even establish it, even though they were required to by the law.

The SGA is in the process of creating a single information point system required for the development and management of a single database on infrastructure at the state level, which will contain electronic data on infrastructure and notifications on planned construction works (Figure 5).

Implementation of Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks in Croatian legislation, enabled the State Geodetic Administration (SGA) to become the competent body for the establishment of the single information point.

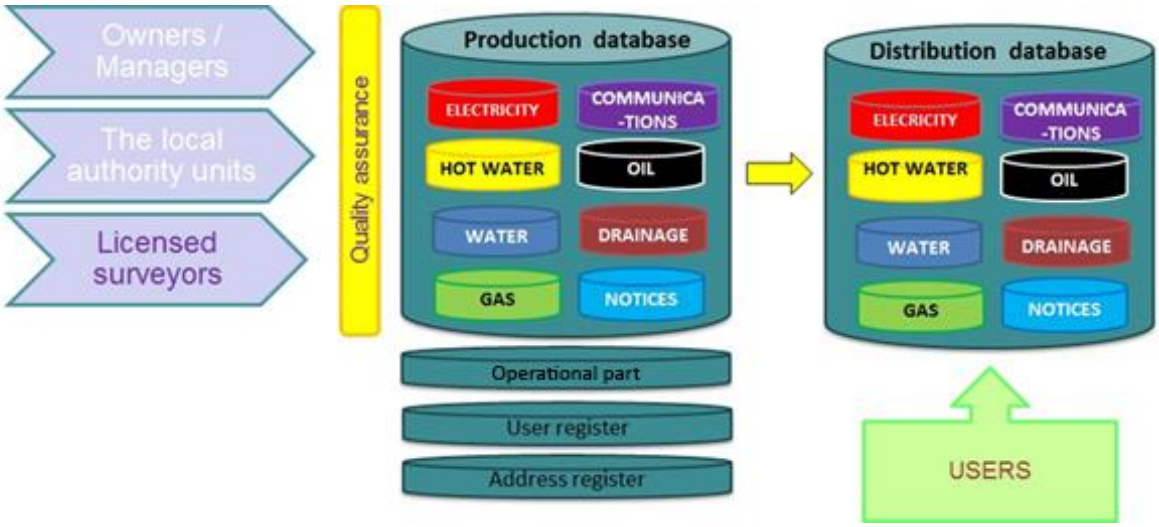

Figure 5. Croatian utility cadastre

The establishment of the single information point will provide data on the existing physical infrastructure and notifications about current and planned construction works. As a result, the efficiency of using the existing physical infrastructure will increase and the costs incurred in carrying out new construction works, as well as costs arising from direct and indirect damages will be reduced. The SGA partly fulfilled its legal obligation for single information point establishment with an application of e-Oglasna ploča (e-Bulletin Board) providing publication of information on current and planned construction works. Network operators are obliged, according to the Act on Deploying High-Speed Electronic Communications Networks, to publish notifications through the single information point for construction works coordination (Abaza Núñez et al. 2018).

5.5. Online services

5.5. 1. The Real Property Registration and Cadastre Joint Information System

The Real Property Registration and Cadastre Joint Information System (JIS) establishment has led to the creation of a unified register for the cadastre and land registers in which the systems are interlinked and exchange real property data. In simplified terms, a unified database and application bringing numerous benefits to the users have been established to keep and maintain the cadastre and land registry data. Apart from the time, needed to access the data and make a registration, being significantly reduced, the citizens are today able to see at one place the ownership structure of a real property and its location in space as well as numerous other functionalities.

One part of the JIS is „One-Stop-Shop“ (OSS) – a single service point for accessing land registry and cadastre data (URL 3).

The OSS includes two components:

- OSS public application - accessible to all users, regardless of the registration, and allows for searching and viewing the basic land registry data and the basic cadastral alphanumerical and graphic data.
- OSS for registered users - available to registered users only and enables data viewing, filing applications for obtaining public deeds and solving at land registry and cadastral offices as well as receiving officially composed documents.

5.5. 1. Cadastre in motion

“Cadastre in motion” is driven by the idea of bringing complex cadastral and land registry systems closer to citizens, visual identities, intuitive use of data retrieval, information visualization, easy retrieval and sharing of information, and accessibility to every user at any time using easily accessible technologies. This portal brings together the services developed by the State Geodetic Administration in response to the demands of today's modern use of spatial data. The system uses a digital cadastral map, digital orthophoto maps, topographic maps of various scales and the Croatian Basic Map as a graphic basis. Every day, users are increasingly using the features provided by the "cadastre in motion", and the portal is accessed by more than 3000 users daily. The "locate me" functionality is the most attractive and the most used one, and depending on the current location of the user, it is possible to retrieve different information about the property itself, as well as information about the nearest authorized surveyor or cadastral or land registry office. Searching for cadastral parcels has been simplified and made possible for the user, with search by parcel number, search by address and geographical name (URL 4).

6. CONCLUSION

Geodesy is a field of expertise that is nowadays intertwined with geo-information and many other areas of expertise, as is evident in all projects run by the SGA. The SGA does not have enough professional staff to realize all the projects and programs that this administration is launching in order to improve the data and services. For this reason, the State Geodetic Administration has decided to implement some of the programs through the public-private partnership model. This model has proved to be a very good option because it promotes private entrepreneurship, generates economic growth and achieves desired results in the shortest possible time. The good results of this model are also due to the fact that every contracted job is controlled by authorized employees from the SGA or from other contracted authorized person.

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URL 4. www.cadastre.hr access to the site: 25th January 2020

BIOGRAPHICAL NOTES

Nikola Vučić graduated in geodesy from the University of Zagreb, Faculty of Geodesy. In 2015, he received a PhD from the University of Zagreb for the thesis “Support the Transition from 2D to 3D Cadastre in the Republic of Croatia”. He was employed at cadastral office in Glina from 1999 to 2004. He was the Head of the Department for Administrative and Professional Supervision at the State Geodetic Administration of the Republic of Croatia. He

was the Head of Sector for Cadastral Programs and Special Registers at the State Geodetic Administration of the Republic of Croatia. Currently he is the Head of Division for Special Registers at the State Geodetic Administration of the Republic of Croatia. His main research interests are land administration systems, 3D cadastres and geoinformatics. He is a member of the Croatian Geodetic Society and the Croatian Chamber of Chartered Geodetic Engineers.

Jelena Unger graduated in geodesy from the University of Zagreb, Faculty of Geodesy. She was employed at the surveying division of food factory Podravka. From 1990 to 1995, she was employed at the Koprivnica-Križevci County, cadastral office Koprivnica, as a cadastral officer. From 1995 to 2000, she was employed at the Koprivnica-Križevci County, cadastral office Koprivnica, as the Head of office. Since 2000, she has been the Head of the Regional Cadastral Office in Koprivnica. Her main interests are land administration systems, improvement of cadastral data and geoinformatics.

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