STOKIS AND ZIS - POSSIBILITIES OF COMMON UPDATING

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Summary: *By establishing of the Common Land Registry and Cadastre Information System (ZIS) in the Republic of Croatia, a unique register of cadastre and land registry was created. Systems are interconnected and exchange property-related data. A unique database and application for managing and maintaining cadastral and land registry data have been established. In the year 2010, within the Official Topographic Cartographic Information System of the Republic of Croatia (STOKIS) the basic topographic database and cartographic database were completed, together with the topographic map scale 1: 25000. Currently STOKIS database update is in process. The question that logically implies itself is whether it is possible and how to link ZIS and STOKIS and eliminate, at least to a certain extent, double data collecting. This paper uses experiences from the German ATKIS (Official Topographic-Cartographic Information System) and ALKIS (Automated Real Estate Cadastre Information System).*

Keywords: *AAA, STOKIS, updating, ZIS*

1. INTRODUCTION

Geoinformation data basis, their structure, developement and updating have been one of the topics researched in the last few decades. A lot has been accomplished in that field including object-oriented data basis structure. That structure can help us to go further in our research and to develop new possibilities.
The question that raise itself is how to make further geodata production faster and easier, but within the frame of the same quality. A lot has been done so far, in the world, in the field of data collecting once and using them multiple times. Jet, a lot more could be done and this paper goal is to go step further on this topic.

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2. ZIS - COMMON LAND REGISTRY AND CADASTRE INFORMATION SYSTEM

The land registration system differs from country to country depending on the needs and the legal system of an individual country as well as on the historical circumstances.
In the Republic of Croatia, the system of registration of land parcels and related interests is based on two registers - Cadastre and Land Registries. According to the "Law on State Survey and Real Estate Cadastre", the (Real Estate) cadastre is a "record containing data on land parcels and buildings permanently lying on, or below the Earth's surface and on special legal regimes on the Earth's surface" [1].
According to definition of [2], "a cadastre is normally a parcel-based, and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities)." It usually consists of geometric descriptions of land parcels and records that describe the nature of the interests related to those parcels (the ownership or control of those interests). Information about the value of the parcel and its improvements is often included too. Cadastre can be established for different purposes such as fiscal purposes, legal purposes or land management, but in any case, it supports sustainable development and urban and rural planning by providing all the relevant information [2].
On the other hand, Land Registers are records that contain data on the legal status of the real estate and are publicly available. The two registers have been updated separately in the Republic of Croatia for a long period of time. Since the year 2016, Cadastre and Land Registry are mostly updated together inside the Common Land Registry and Cadastre Information System (ZIS - Zajednički informacijski sustav zemljišnih knjiga i katastra) [3]. Why mostly? The data of two registers are mutually connected only in those cadastral districts where a new survey has been performed. Other districts still have an incompatibility of real estate data in Cadastre and Land Registry. In the near future that problem will be solved.
ZIS was developed as a part of the project Real Property Registration and Cadastre National Program, short called Organized Land, which was launched in the year 2003 by the Ministry of Justice and State Geodetic Administration. The introduction of ZIS has created a unique system that interconnects Cadastre and Land Registers, that is, a unique database and applications for their management and maintenance [3]. It is consisted of data stored in Land Database (BZP - baza zemljišnih podataka Republike Hrvatske), Land Register data, Land Cadastre data (the old national cadastre) and Real Estate Cadastre (the new national cadastre) data [1].
BZP contains cadastral data on the name of cadastral district, number of cadastral parcel, cadastral parcel address, shape, area, construction and mode of use, which are under the jurisdiction of cadastral authorities; and land registry data on the right holders, legal facts and personal relationships for which are competent municipal courts [1].
One of the main goals of the Organized Land project and the establishment of ZIS is linking the Cadastre and Land Registry data and creating a unique database, which would accelerate access to data and processes of changing legal relations on land, and provide citizens with access to information about ownership structure of a real property and its location in space at one place [3].

According to [1] until the cadastral plan data and the BZP data are connected, the cadastral plan in digital form will be conducted as a database of the digital cadastral plan together with the corresponding cadastral data database.
One of the ZIS segments is also previously mentioned graphical part of cadastral records - a Digital Cadastral Plan (DKP - digitalni katastarski plan). According to [1] "a cadastral plan of Real Estate Cadastre must contain information on: cadastral parcel numbers, cadastral boundaries and other boundaries of cadastral parcels, boundaries of the types of uses of parts of cadastral parcels, addresses of cadastral parcels and buildings (location, form, type of use and house number)."
Cadastral plan is kept in electronic form in ZIS and is produced according to the "Technical Specifications for making the Digital Cadastral Plan and the graphic part of the Digital Geodetic Reports (DGE)", based to which a digital geodetic report is also developed. It is a technical basis for the establishment and maintenance of a Real Estate Cadastre and the implementation of changes in Land Cadastre [3, 4].
Since September 1, 2018, System of Digital Geodetic Reports (SDGE - Sustav digitalnih geodetskih elaborata) has been introduced in the Republic of Croatia as a comprehensive application linked to ZIS, which covers the overall process of making a digital geodetic report starting with the initial data download in the GML format, preparation and elaboration of the geodetic report in digital form, and finally electronically submitting a report to the relevant cadastre office for review and confirmation [3].
SDGE will enable daily update of the data in ZIS. Looking in a long term those data will be more accurate than those in STOKIS (Službeni topografsko kartografski informacijski sustav Republike Hrvatske).

3. STOKIS - OFFICIAL TOPOGRAPHIC-CARTOGRAPHIC INFORMATION SYSTEM OF THE REPUBLIC OF CROATIA

In 1992, the State Geodetic Administration (SGA) started working on the Official Topographic Cartographic Information System (STOKIS), within which the topographic and cartographic data models were defined. The first part of STOKIS is a Croatian topographic information system (CROTIS - Hrvatski topografski informacijski sustav) [5].
CROTIS is a model of topographic data organization that prescribes the classification of topographic data in their collection, processing, accuracy, presentation and transmission. It came into force in 2002 by a decision of the Director of DGU [6].
The CROTIS model includes a set of topographic data within STOKIS. In the first phase of CROTIS, a Basic Topographic Database (Temeljna topografska baza - TTB) was created. It is based on, for this purpose, elaborate specification of topographic data [6].
The data contained in the TTB are topologically processed original photogrammetric measurements and they represent the most accurate and detailed data that is generated, among other things, to make the topographic map at scale 1:25 000 (TK25) [7].
CROTIS has over time experienced more versions. It has been advanced and improved in accordance with modern standards.
In 2006, a project "Construct of CROTIS data object-oriented conceptual model and construct of GML application scheme" was drafted with the aim of improving and aligning the CROTIS Topographic Information System of Republic of Croatia with the

current ISO and OpenGIS standards in the domain of data models, catalogues and data exchange. Modification of the model concerned only the technical part of the data model. The model data, catalogue and GML application schema were created [7].
The CROTIS startup catalogue contained classes with its associated geometry, partially described class definitions, attributes and attribute values. Catalogues prescribed by ISO standard 19110 describe in detail the catalogue version, classes, classes definition, attributes, attribute binding, etc. [9].
All objects are listed in the class catalogue which, according to the classification for a particular geoinformation system, form part of it. Obligatory attributes and criteria for their collection and accuracy, with the way of geometric representation, are the most essential elements that the creator of the information system must keep in mind [10].
Additionally, when collecting data, the principles of functional hierarchy needed to be taken into account. Each class, also, had to be defined by primitive graphic elements (point and line) and the corresponding code [9].
In 2010, the first edition of 594 lists of TK25 was completed, covering the entire territory of the Republic of Croatia. At the same time, TTB has been completed covering the entire territory of the Republic of Croatia. When all TK25 sheets were made, the updating of TTB as the starting point for printing the second edition of TK25 it has been started. For this purpose, The specification of TTB update was created and the updated TK25 lists were created [11].
For updating purposes, the data are divided into three groups into TTB. The update of the first two groups has been defined on a yearly (first group), or four-year (second group) level [6]. The third group will not be updated for now.
The second edition of TK25, except the updated data, different from the first edition of the format display, one unique network (transverse Mercator projection, GRS80 ellipsoid) and display the magnetic declination [12].
The data format in TTB is a vector, and points, lines, and polygons represent object geometry. TTB data are released today upon request with a signed contract. The data are available in a variety of formats (.ffs, .shp, .mbd, .gdb) in the state reference system of the Republic of Croatia - HTRS96/TM [7].

4. THE GERMAN MODEL AAA (AFIS-ALKIS-ATKIS)

The idea of this paper is to, based on German expirience, examine the possibilities to to some extent merge Croatian databasis of ZIS and STOKIS and update them simultaneously. So, further will be described the German AAA model for connecting AFIS (Official Geodetic Control Station Information System - Amtliches Festpunktinformationssystem), ALKIS (Authoritative Real Estate Cadastre Information System - Amtliches Liegenschaftskataster-Informationssystem) and ATKIS (Official Topographic Cartographic Information System - Amtliches Topographisch-Kartographisches Informationssystem).
Geoinformation of official surveying and mapping in Germany includes information on the control stations. Because these originally belonged to neither ALK (automated cadastral map - Automatisierte Liegenschaftskarte) nor ATKIS, they are now modelled in their own information system called Official Geodetic Control Station Information System AFIS (Amtliches Festpunktinformationssystem) with a separate feature

catalogue

The developments of the components of the cadastral databases for maps ALK and textual descriptions called ALB (automated property register - Automatisiertes Liegenschaftsbuch) started in Germany in the 1970s and 1980s. They were developed by the surveying and mapping authorities under the technical environment and possibilities at that time. Both information systems, ALB and ALK, define the basic land information system. A new project called ALKIS will replace ALK and ALB [14].

The Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV , *Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland*) decided to design a new and future-oriented system, ALKIS, in combination with a redesign of the official topographic and cartographic information system - ATKIS [12]. In ALKIS all information will be stored in one object-oriented database system in compliance with the standards set out by ISO/TC 211 and the Open Geospatial Consortium (OGC) [14] and will be, as much as possible, compatible with ATKIS.

ALKIS in combination with ATKIS is designed to:

- process all necessary cadastral and topographical data for a parcel-based map and register of land owners, land use, and more unified basic data,
- control the use and maintenance of the system, and
- enable the use of the entire geographical data of the surveying authorities by all users via a metadata system including quality information [14].

The modeling of ALKIS and ATKIS is fully based on the ISO standard UML, with the definition of the data interface in extensible markup language (XML) [14].

The feature catalogue of the real estate cadastre and the topographic state survey have been semantically harmonised with a view to achieving a highly-standardised real world model. Harmonisation has benefits for both internal and external applications. It is based on previous ALK and ATKIS catalogues [13].

Right now there is a great demand for access to geoinformation data from new users such as the financial sector, lawyers, and notaries. Generally, all users need up-to-date data for their applications. So, fast data transfer or even an online access to these data using SDI technology could be very helpful [14].

GIS and CAD users are very interested in the construction of 3D models that build on the official real estate cadastre data, in order to be able to display and better visualise their plans based on these official foundations. Furthermore, a uniform 3D model based on the GeoInfoDoc can be a suitable platform for storage of the incidental 3D information. Currently there is no official certification for this information [13].

As an example for 3D modelling need, the EU Directive for reducing environmental noise (2002/49/EG) stipulates the future, regular, detailed noise propagation calculation that can only be based on a continuously updated 3D models of towns. The 3D information built on GeoInfoDoc offers the foundation for the determination of environmental noise, offers update mechanisms and enable the required, regular checking of noise categories through the use of versioning / historicization concepts [13].

The task of the AFIS-ALKIS-ATKIS Reference Model is to put the geodata inventories and their associations in context [13].

5. CONCLUSION

Development of STOKIS, ZIS and especially latest SDGE in the Republic of Croatia is giving a possibility to think further ahead. In the near future production processes could be simplified and faster including updating.
If all state official geoinformation data bases would be connected, it would give producers the possibility for a new thinking and a new processes. One of them is collecting data once and using them multiple times. The other is presenting them to new users.
We analyzed solutions that have been given in the German AAA model. It shows that data bases connecting makes sense. It also give us a rough model of what should be done in ZIS and STOKIS to accomplish that. The feature catalogues should be unified. It should be found out what data could be collected once and used in both scales (multiple times) using the automatic generalization. The new market and new users should be identified and it should be found a model how to approach them.
It would be a shame not to use state geoinformation data in all possible ways, since they already exist in vector form. That should be one of the future goals of the state geoinformatic data producers and this paper should be seen only as a first step in accomplishing that. Further research will follow.

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СТОКИС И ЗИС - МОГУЋНОСТИ ЗАЈЕДНИЧКОГ АЖУРИРАЊА

Резиме: *Успостављањем заједничког земљишнокњижног и катастарског информационог система (ЗИС) у Републици Хрватској успостављен је јединствени регистар катастра и земљишних књига. Системи су међусобно повезани и размјењују податке везане за имовину. Успостављена је јединствена база података и апликација за управљање и одржавање катастарских и земљишнокњижних података. У 2010. години, у оквиру Службеног топографско картографског информационог система Републике Хрватске (СТОКИС), завршена је основна топографска база података и картографска база података, као и топографска карта 1: 25000. Тренутачно је у току ажурирање СТОКИС базе података. Питање које се логично намеће јесте да ли је могуће и како повезати ЗИС и СТОКИС и елиминисати, барем у одређеној мери, двоструко прикупљање података. Овај рад користи искуства из немачког АТКИС-а (службени топографско-картографски информациони систем) и АЛКИС-а (аутоматизовани информациони систем за катастар непокретности).*

Кључне речи: *ААА, СТОКИС, ажурирање, ЗИС*