

Towards Integration of Cadastral Land Information System in Republic of Kosovo

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SUMMARY

Security of ownership is a prerequisite for a functioning land market. Real property rights must be registered and the ownership information should be easily accessible. The authorities should guarantee the content and transparency of the register. This register forms a strong basement for the development for Republic of Kosovo. The functioning of the cadastral system in the Republic of Kosovo is based on a series of laws and regulations. From 15 June 2008 when the Constitution of Republic of Kosovo entered into force (Constitution of Republic of Kosovo 2008), the right to own the property is guaranteed, and the use of property is regulated or will be regulated by the law in accordance with the public interest. Kosovo Cadastral Agency is responsible for the development of the legal framework and the coordination of its implementation relating to the cadastre and other matters concerning the cadaster land information system in Republic of Kosovo. The KCA's areas of competence are geodesy, surveying, geographical information systems, real property registration, mapping and legal issues related to land administration.

The objective of Cadastral Land Information System in Republic of Kosovo is the harmonization of the cadastral legal part (textual base) with the cadastral map (graphical part). This objective leads towards tomorrow's vision regarding the Land Administration, and meets the Cadastre's requirements for Cadastre 2014 and Cadastre 2.0 (2020) general vision, where the integration of legal and mapping data is significant step for the future Cadastre. Kosovo Cadastre Land Information System (KCLIS) has been conceived of as an integrated multi-purpose system that is composed of a number of key conceptual modules and is as a base system for NSDI in Kosovo. It replaces the Immovable Property Rights Register (IPRR), providing a more secure, robust and efficient system with increased functionality. KCLIS is a dynamic system and is designed to grow and to develop further. The primary role of KCLIS is to assure immovable property rights registration in Kosovo. It serves both KCA and MCO organizations and the management of both graphical and textual data.

KCLIS integrates office routines, sales of data, additional services that relate to cadastre, functions for more effective management, security and IT support. Until now the textual part (KCLIS – T) is functional in all MCO's in Kosovo and mapping part (KCLIS-CM) will be implemented by mid of 2015.

All this achievements of Cadastre development in Kosovo would not be possible without invaluable support of the donors, such as the World Bank, Norwegian Government German Government (GIZ) etc. This paper presents the developments of Cadastre in Kosovo with main focus on the integration of Textual and graphic information within Kosovo Cadastral Land Information System.

PËRMBLEDHJE

Siguria e pronësisë është parakusht për një treg funksional të tokës. Të drejtat e pronës duhet të regjistrohen dhe informacioni i pronësisë duhet të jenë i çashtëm. Autoritetet duhet të garantojnë për përmbajtjen dhe transparencën e regjistrimit. Ky regjistër formon një bazament të fortë për zhvillimin e Republikës së Kosovës. Funksionimi i sistemit kadastral në Republikën e Kosovës bazohet në një varg ligje dhe rregullore. Prej 15 qershorit 2008, kur Kushtetuta e Republikës së Kosovës ka hyrë në fuqi (Kushtetuta e Republikës së Kosovës 2008), garantohet e drejta e pronës, dhe përdorimi i pronës rregullohet ose do të rregullohet me ligj, në përputhje me interesin publik. Agjencia Kadastrale e Kosovës është përgjegjëse për zhvillimin e kornizës ligjore dhe koordinimin e zbatimit të tij në lidhje me kadastrën dhe çështje të tjera që kanë të bëjnë me sistemin e informacionit kadastral për tokat në Republikën e Kosovës. AKK-ja ka kompetenca në këto fusha: në gjeodezi, matje, sistemet për informacione gjeografike, regjistrimin e pronës së paluajtshme, përpilimin e hartave dhe çështjet ligjore që kanë të bëjnë me administrimin e tokës. Qëllimi i Sistemit të Informacionit Kadastral për Tokat në Republikën e Kosovës është harmonizimi i pjesës kadastrale ligjore (pjesa tekstuale) me hartën kadastrale (pjesa grafike). Ky objektivi çon drejt vizionit të së ardhmes lidhur me Administrimin e Tokës, dhe i plotëson kërkesat e kadastrës për Kadastrën 2014 dhe Kadastrën 2,0 (2020) vizion të përgjithshëm, ku integrimi i të dhënave ligjore dhe ato të hartës janë hap i rëndësishëm për të ardhmen e Kadastrës.

Sistemi i Informacionit Kadastral për Tokat e Kosovës (SIKTK) është konceptuar si një sistem i integruar për shumë qëllime, që është i përbërë nga një numër i moduleve të rëndësishme konceptuale dhe është si një sistem bazë për IKJH-në në Kosovë. Ky sistem zëvendëson Regjistrin mbi të Drejtat e Pronave të Paluajtshme (RDPP), duke siguruar një sistem më të sigurt, të fuqishëm dhe efikas me rritjen e funksionalitetit. SIKTK është një sistem dinamik dhe është dizajnuar që të zgjerohet dhe të zhvillohet më tej. Roli primar i SIKTK-së është që të sigurojë regjistrimin e të drejtave pronësore mbi pronën e paluajtshme në Kosovë. Ajo i shërben AKK-së si dhe organizatave të ZKK-ve si dhe menaxhimit të të dhënave si në pjesën grafike ashtu edhe në atë tekstuale. SIKTK integron përditshmërinë e zyrave, shitjen e të dhënave, shërbimet shitesë që kanë të bëjnë me kadastrën, funksionet për menaxhim më efikas, siguri dhe mbështetje TI-së. Deri tani pjesa tekstuale (SIKTK – T) funksionon në të gjitha ZKK-të në Kosovë ndërsa pjesa e hartave (SIKTK-G (CM) do të zbatohet diku kah mesi i vitit 2015.

Të gjitha këto arritje të zhvillimit të Kadastrës nuk do të kishin ndodhur pa ndihmën e çmueshme të donatorëve, siç është Banka Botërore, Qeveria Norvegjeze, Qeveria Gjermane (GIZ) etj. Ky punim prezanton zhvillimin e Kadastrës në Kosovë duke i dhënë prioritet informatave Tekstuale dhe Grafike në Sistemin e Informacionit Kadastral për Tokat në Kosovë.

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1. INTRODUCTION

The existing Cadastral Map data for all properties in Republic of Kosova, are in digital format and the maintenance of those data until now is made using the *Geomedia* platform with the adopted module *GeosPro-Procalc*.

Geomedia-Professional is used as desktop GIS software, supported with optimised module GeosPro-Procalc, based on the official data model in Kosova. The optimised module is used for the maintenance of graphical cadastral data, processing of land survey data and management of data. Those data are stored in local data base and the backup of data is made manually.

Implementation of new KCLIS-CM (Kosovo Cadastre Land Information System - Cadastre Map) module for maintenance of cadastre graphical data, is continuous development at Kosovo Cadastral Agency with the aim for general completion of the unified and integrated Kosovo Cadastre Land Information System, which is the part of the KCA-s approved strategy for KCLIS.

Technical specifications for development of KCLIS-CM are made by KCA supported by Norwegian and GIZ experts. The founding of application development and project implementation in general is also supported by Norwegian government through authority Statens Kartverket.

The contract for application development is signed in March 2013 with the consortium IN2/IGEA/Cactus (Croatia and Kosova) and the acceptance is done in December 2013.

Below are parts of the KCLIS concept which have been already in operation:

- KCLIS Textual – management of cadastre text information
- KCLIS Graphical – management of map features (raster and vector)
- ARIS – Address registry
- KCA Geoportal – web portal for dissemination of data from KCA
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And the KCLIS-CM Cadastre Map component is seen as an extension of the KCLIS Graphical. The component have a close cooperation with KCLIS Graphical and KCLIS Textual, but the main purpose is to provide storage and specialized functionality to manage land survey data and cadastre graphics, and finally functionality for distribution of this

information to other systems, for example the Geoportal.

Also the KCLIS-CM contains all the necessary tools for the maintenance of cadastral map data based on applicable legislation in force (laws, administrative guidelines, frameworks, guidelines etc).

Starting from March 2014 until now the KCLIS-CM is implemented in total at 24 MCO-s and implementation in remained 11 MCO-s in the Republic of Kosova is planned to be finished in July 2015.

KCLIS-CM is the official unified tool for maintenance of Cadastre Map data during the sporadic and systematic registration of immovable property rights.

The system contains all the necessary tools for the maintenance of cadastral map data based on applicable legislation in force (laws, administrative guidelines, frameworks, guidelines etc).

2. OVERALL SYSTEM CONCPETS

2.1 Main Purpose of the System

Management of Cadastre Map information

The main purpose of the Cadastre Map component is to store, edit and manage the graphical information about the all immovable property units in Kosovo. Textual information about the cadastre units and related documents are managed by other components of the KCLIS.

Management of Land Survey Data

The Cadastre Map component will also manage land survey data (point, lines, and areas) which are the measurement result from the field when using GPS, total stations, etc. Land survey data can be loaded into the database and will be available for construction of different features in the graphical databases, for example in case of defining a Boundary Point.

Fig. 1. below shows the system context of the Cadastre Map (in red colour) which also indicate its relationship to the existing KCLIS Graphical.

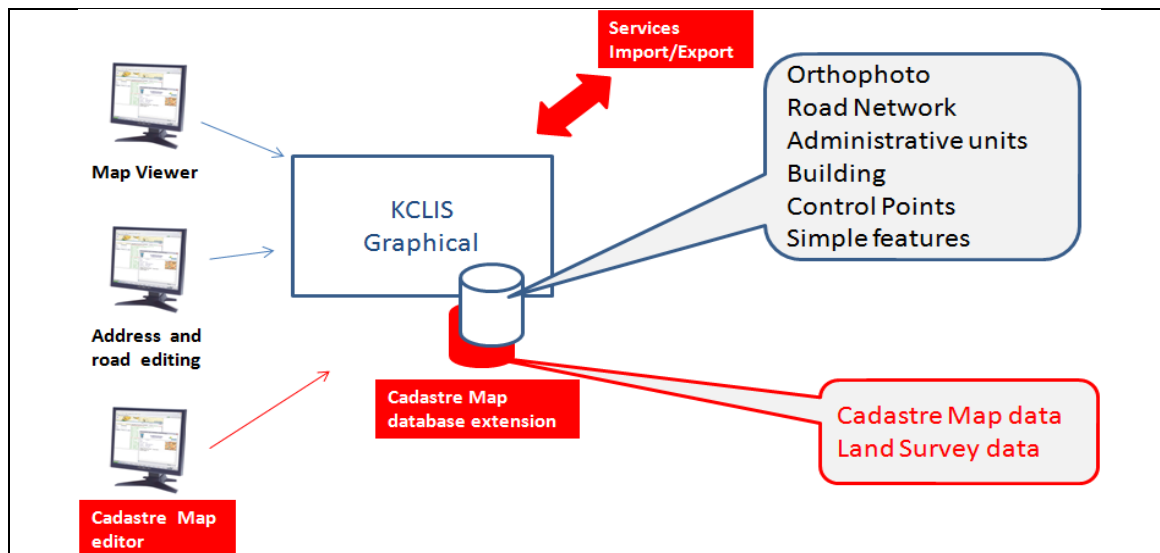


Fig.1. Cadastre Map as an extension of KCLIS Graphical

Based on existing functionality in KCLIS Graphical, the Cadastre Map extension comprises:

- Database storage and management of land survey and cadastre graphics
- A graphical editor for managing land survey and cadastre graphics
- Import and export of land survey and cadastre graphics
- Interoperability with other KCLIS components (services)

The Cadastre Map can alternatively be implemented as extension to existing databases and software components, or as separate databases and an independent software component.

2.2 KCLIS Architectural Principles

2.2.1 System Architecture Principles

The KCLIS system is based on the principles of Service Oriented Architecture (SOA), namely:

1. Each system module operates independently of other system modules.
2. Each system module completely controls the data for which it is responsible.
3. The system modules communicate with each other and with various other clients via interoperability services.

Over the last 10 years, SOA has become a well-known and accepted method used for integration of software modules within a software system. The SOA principles are also applied to the integration of independent systems.

2.2.2 Interoperability Principles

The integration and communication between actual systems will be implemented by use of services. The components in KCLIS will deal with two types of interoperability services, namely: invocation services and web services.

Web Services are services applied between two systems without user interaction. A request for service is sent by one system as a message, and the response from the other system is a message too. SOAP Web Service, WMS and WFS are examples of Web Services. Invocation services are used when the service involves user interaction directly to the system which provides the service.

An invocation service implies that a unique (session) key is defined by the Client. The key will be associated with results which will be stored at the Service Provider. The Client will therefore be able to request the stored data using the key via a final Web Service.

2.3 KCLIS-CM Main Technical Characteristics

System has the following main technical characteristics:

- High security in relation to stored data and system access
- High reliability and availability (>99%)
- High scalability and performance
- Support for multiple languages, on both user interface and stored data level
- Enhanced interoperability capabilities for cooperation with other KCLIS systems (Geoportal, ARIS-address register, KCLIS-Textual, KCLIS-Document Management)
- Historical data storage
- Shared geometry model (topological data model)

Through KCLIS-CM special services which are develop, the all types of cadastral units (parcels, buildings, parts of buildings, right and restrictions and utilities) are replicated in real time in Geoportal (<http://geoportal.rks-gov.net>) for wide range of public users.

2.3.1 Conceptual Architecture

Generally, KCLIS-Cadastral Map component is an extension to the main KCLIS-Graphical module, which will provide basic viewing and editing functionalities.

This module is used directly by internal users and indirectly by external ones through the publicly available Geoportal.

Geoportal users are read-only with the additional ability to report errors and order/purchase data.

In total there are 5 groups of users shown in Fig. 2.

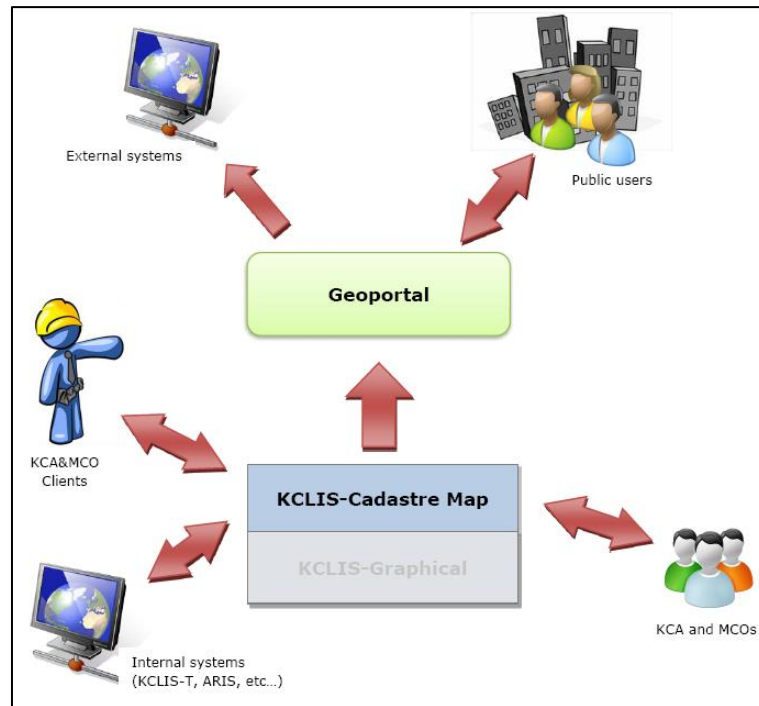


Fig. 2. Conceptual architecture of KCLIS-CM

System is developed as an extension of the KCLIS-Graphical component, utilizing its modular design. Design principles are partly dictated by the ones used for the previous KCLIS-Graphical:

- Use of open industry standards
- Use, as much as possible, of Open Source and free technology
- Utilization of existing KCLIS-Graphical functionalities
- Integration with other existing and future KCA systems
- Main solution for management of graphical cadastre data
- Technical design based on Service Oriented Architecture
- High availability and scalability

2.3.2 Software Solution

All software, except for Microsoft Windows Server, Microsoft SQL Server and Microsoft IIS is fully OpenSource and as such does not incur any licensing costs.

Table 1. Software List

Name	Description	Manufacturer
vSphere	Virtualization platform	VMware
Windows Server 2008R2	Operating System	Microsoft
SQL Server 2008R2	RDBMS	Microsoft
IIS	Web and Application server	Microsoft
Reporting Services	Reporting tool	Microsoft
Geoserver	GIS server	OpenSource
GeoExt	Web Mapping API	OpenSource
Nagios	Monitoring tool	OpenSource

3. IMPLEMENTATION KCLIS-CM

Process for project implementation is divided in the three main phases:

- Development of application by company and partial testing of delivered functionalities through three iterations
- Testing of completed application at KCA with the two pilot Municipalities
- Final application acceptance
- Training of users in test environment (data base) in average 5 working days,
- Data correction and migration (upload) of corrected data in production-real environment.
- Support of users (on job training) for independent work in production-real environment.



Fig. 3. KCLIS-CM training of end users

4. ADVANTAGES OF KCLIS-CM

Advantages of KCLIS-CM in offering the services and connection of geo-information with property right records are:

- Integration of the two bases with cadastral data (Textual -Cadastral Map), Fig. 5
- Quick comparison and analysing the consistency and reliability of the cadastral data between data bases,
- Correction of inconsistencies on cadastral data between the two databases,
- Increase the data quality and update status in cadastral data,
- Presentation in real time on National Geoportal on updates and changes made on all graphical cadastral data, as information for the owners and interested public users, Fig. 4
- Facilitate the check and processing of the cadastre data which represent the situation before 1999 and it is expected to be returned by Serbia,
- Creation of several statistical reports: QA/QC report, report on changes, report on neighbour units, report on inconsistency between graphical and textual data, comparison of all existing data (textual and graphical) etc.
- Wide flexibility for user administration and editing rights management



Fig. 4. Replicated cadastral data in National Geoportal

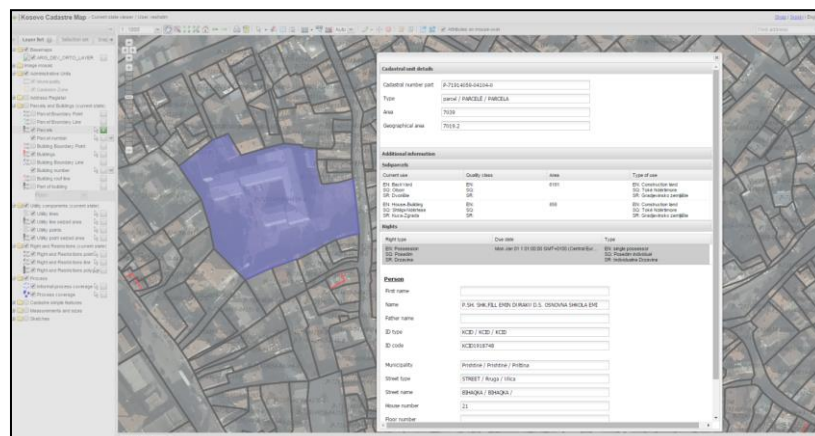


Fig. 5. KCLIS-CM (comparison of data Graphical-Textual)

5. CONCLUSIONS

The objective of Cadastral Land Information System in Republic of Kosovo is the harmonization of the cadastral legal part (textual base) with the cadastral map (graphical part). This objective and implementation of KCLIS-CM leads towards tomorrows' vision regarding the Land Administration, and meets the Cadastre's requirements for Cadastre 2014 and Cadastre 2.0 (2020) general vision, where the integration of legal and mapping data is significant step for the future Cadastre.

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BIOGRAPHICAL NOTES

Prof. Dr. Murat MEHA is a CEO of Kosovo Cadastral Agency, a University Professor and Head of the state Border Demarcation Commission. He teaches at the University of Prishtina - Kosovo since 1988. He has also taught for ten years at Tetova University (FYR of Macedonia). He worked for five years as Manager of SEO Ferronikel, for three years as a CEO of Kosova Cadastre Agency, in different funded EAR projects, USAID project, KTA etc. His research studies are mainly related to survey, cadastre, Land Administration and Land management and related educational and capacity building activities. He is currently member of Kosova Surveyor Association. The main publications of Mr. Meha are on survey, cadastre, Land Administration and Land management.

He published two University books, two books for Kosovo Cadastre Agency, one of them was translated, and several school geographic atlases and maps. He has more than 80 professional and science papers in different professional magazines, symposiums, conferences etc. Most of these articles are available on Internet at: FIG, ICC, Euro Geographic, WPLA, CELKCenter, FAO GIM International etc.

Joep CROMPVOETS, Born on 28 August 1968 in Oss, The Netherlands. He completed PhD, Wageningen University, The Netherlands (2006) Thesis: “National Spatial Data Clearinghouses, Worldwide Development and Impact”. Currently is working as senior researcher, project manager and senior consultant of the Public Management Institute at Katholieke Universiteit Leuven, Belgium. He has more than 250 publications in the field of geo-information science (with emphasis on spatial data infrastructures and soil science) and ± 50 scientific papers submitted to International Journal of Geographical Information Science. He is member of the: Board of Directors of the Global Spatial Data Infrastructure Association, GSDI Review commission, International Geospatial Society, AGILE Scientific Committee etc.

MSc. Muzafer ÇAKA, born on 16.06.1969 in Kaçanik, Republic of Kosovo, graduated in geodesy and geo-informatics in University of Zagreb, Croatia. He completed his master’s degree (MSc) at Royal Institute of Technology (KTH) in Stockholm, Sweden. He worked in the Cadastre Department in Kaçanik and in 2001 became a Director of Department for Geodesy Cadastre and Property in Municipality of Kaçanik. From January 2008 he works in Kosovo Cadastral Agency as a Head of Project Coordination Office in supporting the coordination of project activities for cadastre development supported from donors: World Bank, Norway Government, GIZ etc. Until 2011, he was Vice-President of Kosovo Association of Surveyors. He is a national delegate in the FIG commission no. 9.

Reshat Murati, born on 24.03.1968 in Gjilan, whereas its studies in University of Geodesy in Zagreb, Croatia. His current activities and tasks are: Team Leader supporting in implementation of KCLIS-CM, Project manager and head of KOPOS sector (Kosovo Positioning System), advisor in drafting technical specifications and development of projects in Cadastre Reconstruction and Building Cadastre, advisor in updating guidelines for cadastral measurements and maintenance of digital cadastre.

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