Land Administration Data Dissemination Processes: A Case Study in Croatia

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Key words: LADM, Cadastre, Processes, Dissemination, Croatia.

SUMMARY

In the first edition of LADM the land administration processes were omitted as they were considered to be country specific. This view is now under reconsideration as the future extensions of LADM are planned and developed. The processes within land administration domain are, namely, registration and dissemination. The research concerning modeling of the LAS processes is somewhat in a scarce state as the majority of the research was directed towards registration activities such as subdivision, real-property transfers, and property formation. The authors deem that the proper dissemination of LAS data is a prerequisite to above-mentioned processes, and it could be stated that this domain of the land administration dynamism is relatively poorly researched.

The research presented in this paper analyzes one use-case scenario of land administration data dissemination process in Croatia. The analyzed use-case depicts the process in which cadastral certificates are utilized to gain additional land-related information, which in this case study, was the spatial planning data concerning one cadastral parcel. The aim of this research was to examine how the land administration data dissemination processes could be optimized and improved in a standardized formal manner. The model outlining the process of disseminating both cadastral and spatial planning certificates was formalized by means of use-case diagram. From the formalized process, the elements, such as actors, activities, input/output data were determined and matched with existing LADM classes, while the importance of data interoperability and timeframe of the said processes were also addressed. The paper also discussed how would the formalized process look if the LAS data was interoperable within one service, pointing out that this would lead to a much more time-efficient and user-friendly access to the disseminated LAS data for the current and future LAS users.

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1. INTRODUCTION

Cadastral system registers, as one of the key registers of any Land Administration System (LAS), play a role in granting access to land information and maintaining cadastral system data in accordance with transactions that occur on land. At the same time, LASs are not sufficiently flexible to accommodate or support the growing number of complex commodities (water, biota, mining, carbon credits, etc.) and other interests (environmental, use restrictions, etc.) in land. This inflexibility is caused by traditional concentration on a data model that is based on the physical land plot (the cadastral parcel) as a single means of organizing land information (Kalantari et al., 2008). According to UNECE, LASs consist of human and technical resources which together with appropriate organizing procedures are applied to the collection, storage, retrieval, dissemination, and use of land-related information. These resources may focus on environmental, infrastructure, cadastral or socio-economic information (UNECE, 1996). However, the growing demand for cadastral system data, as the core data of land administration, urges the need for more explicit process modeling and more research in the field of cadastral system data dissemination processes (Križanović and Roić, 2020).

The data dissemination practices, within various types of LASs, might be considered outdated, as in most cases the digitization of land administration data was conducted to match the paper-based system (Mađer, 2012; Križanović et al., 2021).

The conceptual model describing the land administration systems, the Land Administration Domain Model (LADM), represents the basis for modeling static components of the system, and this model does not include processes for initial data acquisition, data maintenance or data dissemination. One of the main reasons why the processes were not affected by the LADM was because said processes were considered to be country-specific when the first edition of the LADM was prepared. This view is now under reconsideration and according to the documents relating to the new scope of proposals for the LADM revision, processes are yet to be modelled and are planned as an extension to the current edition of the LADM (Lemmen et al., 2017, 2018, 2019, 2021; van Oosterom et al., 2019).

It could be stated that the research regarding LAS processes is in a scarce state but there are research papers that cover certain aspects of the land administration processes which can be used as a starting point for the future developments in the dynamic field of land administration (Krigsholm, Riekkinen and Ståhle, 2018; Vranić et al., 2021).

An excellent starting point in the LAS process modelling was set by the COST G9 action. The main objective of the action was to improve the transparency of real property markets and to provide stronger basis for the reduction of costs of real property transactions by preparing a

set of models of these real property transactions. During their research the authors met serious difficulties when comparing data from countries in the study, and as result they proposed the standardized terminology and adopted the Unified Modelling Language (UML) as a tool for modeling the processes. The UML has proven to be useful for modelling within the land administration domain, as it was employed both in CCDM and LADM (Arvanitis and Hamilou, 2004; Zevenbergen, Frank and Stubkjær, 2007; ISO, 2012).

Furthermore, the analysis of cadastral systems and the processes that affect them resulted in recognition of two main processes, namely registration and dissemination. The registration adds a new document to the register while dissemination of data returns the information to the user (Navratil and Frank, 2004).

Today, the LASs have diversified services and functions to manage interests in land. For example, the land register places emphasis on the management of private rights, restrictions, and responsibilities (RRRs) on land parcels. At the same time the land development i.e., the spatial planning system, is concerned with use restrictions imposed by the spatial planning authorities, while the valuation system focuses on the economic functions of the land. Even though these processes seem to be independent, each of them relies on, or is related to, the land parcels or properties (Kalantari et al., 2006). This, however, poses the need for national land administration infrastructures, as in most cases the land information and processes are frequently disaggregated across states, provinces, cantons, counties, or municipalities. Furthermore, the data and services should relate to more than one of the land administration functions alongside the users' awareness for better land administration infrastructure is vital for future developments in field of land administration data dissemination processes (Bennett et al., 2012).

In this paper, the authors will examine one of the use-case scenarios in which Croatian cadastral certificates are utilized to gain additional land-related information. The use-case scenario examined in this paper was derived from the purposes of retrieving the cadastral certificates available from the Joint Information System (JIS) in Croatia, which serves as the main platform for the dissemination of the official cadastral certificates in the electronic environment (URL1).

The aim of this research is to examine how land administration data dissemination processes can be optimized and improved in a standardized formal manner. In order to achieve said aim, the model outlining the process of retrieving spatial planning data concerning one cadastral parcel was developed and analyzed.

Regarding the structure, the methodology is outlined, consisting of the resources and tools used to develop the above-mentioned model. Subsequently, the land administration data dissemination infrastructure for the formalized process will be described. Analysis and results will be described in Section 4, detailing the developed use-case diagram and its elements. The paper ends with discussion and conclusion accompanied by future work recommendations.

2. METHODOLOGY

The research began with a search and inspection of various use-cases where the cadastral certificates are required as the input data to gain additional land-related information or to exercise some right, e.g., construction. The main platform for searching and inspecting cadastral data was provided by the JIS. The JIS serves as a One-Stop-Shop (OSS) for obtaining cadastral certificates concerning one or more cadastral parcels. The certificates provided by the JIS are the Possessory Sheet Transcript, the Land Book Extract and the Cadastral Map Copy. The above-mentioned certificates can be obtained in two ways, as a registered and an unregistered user, with the main distinction being that the certificates obtained as unregistered user are marked as unofficial copies, and therefore can only be used to gain basic information regarding the cadastral parcels. In order to obtain official cadastral certificates, the users must have some sort of authorization. The authorization is available via electronic ID, internet banking, digital certificate etc., and each of these methods of authorization is distinguished by the level of security.

After the process of authorization, the users can search and retrieve cadastral certificates concerning one cadastral parcel. As they do so, the users are required to choose for which purpose they request and download the certificates. Currently, the JIS offers thirty-six different purposes for obtaining the certificates. These purposes can be grouped into standard land administration functions such as land use, land development, land value and land tenure, and they might be considered as the use-cases of official cadastral certificates.

However, as this sole process of obtaining cadastral certificates may be somewhat easy, the authors have decided to examine how the processes that follow the dissemination of land administration data continue. In order to do so, the process regarding the dissemination of spatial planning certificates concerning one cadastral parcel was formalized using the UML use-case diagram.

The methodology employed in this paper for process modeling was suggested by van Oosterom et al. (2019), and is of a hierarchical nature, consisting of four steps/levels:

Level 1 – Identification of all the actors/elements involved in a process according to the specified elements;
Level 2 – Identification of process phases; in other words, groups or sub-processes relating to a certain topic and provision of a generic description;
Level 3 – Identification of basic activities;
Level 4 – Building of a model.

The authors also suggest that the first two levels may be depicted by use-case diagrams, while Levels 3 and 4 could be presented by means of activity and/or sequence diagrams.

In this paper, the authors have chosen to develop the use-case diagram of the above-mentioned process, identify the actors, activities, and input/output documents of the process, and to provide generic descriptions of the identified elements. Through the process breakdown, it will be also possible to match the elements with the existing LADM classes and

their attributes. Furthermore, the remaining unidentified process elements will be determined, with the ultimate goal of these steps being to point out the future development of process modeling and standardization via LADM extensions.

Finally, the result expected from this methodology is the proposition for further process improvements and optimization for the current and future users of, but not only, the Croatian land administration data.

3. LAND ADMINISTRATION DATA DISSEMINATION SERVICES IN CROATIA

In this section, the land administration data dissemination services in Croatia will be described. However, the services described are only those required for the dissemination of cadastral and spatial planning certificates, as they correspond to the data dissemination process which was examined in this paper. It should also be noted that there are many other land administration data dissemination services available in Croatia, but the ones described in this paper are the only services which provide authoritative data from key registers. The described registers/services are available via the JIS, which is the responsibility of the cadastral authority, i.e., the State Geodetic Administration (SGA) and e-Permit, which is the responsibility of the Ministry of Physical Planning, Construction and State Assets.

3.1 Joint Information System

As of 21 November 2016, the JIS is in full production in all 107 land book offices and in 113 cadastral offices. The basic objective of JIS was to establish a common warehouse of the cadastre and land book, and a single application for keeping and maintaining the core land administration data.

One part of the JIS is the OSS, alluded to above, which serves as a single service point for accessing cadastral and land book data. The OSS consists of two components, namely the public application, and the registered users application. The public application is accessible to all users, regardless of registration, and allows for searching and viewing the basic land book and cadastral data, i.e., the certificates provided by each register. As already mentioned, the public part of the application offers access to unofficial copies of the certificates.

The registered users part of the application enables data searching, viewing, and filing of applications in order to obtain certificates. However, some of the registered users, such as authorized public notaries or lawyers, can also send e-applications for registering the rights in the land book, while the charted geodetic surveyors can obtain cadastral maps in vector format and send geodetic reports to cadastral offices for review and confirmation (URL1).

Through the OSS users can request and download the Land Book Extract, the Possessory Sheet Transcript, and the Cadastral Map Copy. More in-depth descriptions of the above-mentioned certificates can be found in Križanović et al. (2021). The certificates are provided in PDF format and carry an electronic signature, which proves their authorized validity.

This paper will focus on the dissemination of related land administration data sets where the cadastral certificates are required as input data. The variety of purposes, i.e., use-cases for cadastral certificates, are defined by regulations and, therefore, when a user is requesting one or more cadastral certificates must choose the purpose of request. The majority of the purposes correspond to other land administration functions, while the remaining purposes correspond to a variety of socio-economic purposes, such as tax exemption for less developed parts of the country. It could be stated that the processes where cadastral certificates are used as the input data for achieving socio-economic status are country-specific, and therefore standardization and modeling in a global sense is hardly possible. On the other hand, the processes where cadastral certificates serve as the input data, along with other required documents, for obtaining additional land-related data, could be modeled in a standardized formal manner.

According to the statistical data for each chosen purpose of requesting cadastral certificates, one of the most common cases was for the purposes of retrieving spatial planning documents via the e-Permit service. The statistical data was provided by the SGA and during the period spanning 2017 to 2021 the Cadastral Map Copy was issued 45,209 times for the purpose of retrieving spatial planning documents, and this was the most frequent when compared to the statistical results of other purposes.

3.2 e-Permit

e-Permit is the information system of the Ministry of Physical Planning, Construction and State Assets, the role of which is to issue acts permitting construction, i.e., for the conducting of procedures pursuant to the Physical Planning Act and Building Act. The system is implemented at the level of the Republic of Croatia and is applied in all counties, major towns, and towns which are seats of counties and that perform the tasks of issuing spatial planning documentation (URL 2).

While the main purpose of the e-Permit service is to issue construction permits, it also provides the official spatial planning documents, which can be obtained for one or more cadastral parcels. In Croatia, that document is named the Location Information, and it provides the information on all current spatial plans concerning the cadastral parcel, divulging the land use restrictions and other spatial planning regulations affecting the cadastral parcel. Simply, it shows the user in what ways the cadastral parcel can be utilized, and which spatial planning regulations affect the parcel and the surrounding area. A request for this document requires an official Cadastral Map Copy not older than six months, and the predicted timeframe for the execution of the request is within eight days. The request can be submitted directly in one of the spatial planning offices or electronically via the e-Permit service. Electronically submitted requests require users to fill out the electronic request for the Location Information, upload the Cadastral Map Copy, and finally to electronically sign the request. The request may be submitted as a registered user (via e-Citizen registration) and as an unregistered user, with the exception that the request will expire thirty days after the submission.

4. ANALYSIS AND RESULTS

In this case study, the prerequisites for LAS user included having general knowledge about the dissemination of land administration data, such as how to use cadastral data dissemination services and spatial planning data dissemination services while the user also had to have authorized registration for fulfilling the examined process. Another prerequisite was, knowledge regarding basic cadastral data information, such as the cadastral municipality where the cadastral parcel is located and the parcel ID. Extending this point further, the cadastral municipality and parcel ID are prerequisites for any Cadastral Map Copy request, as the JIS does not currently offer any other search criteria for cadastral parcels, apart from visual searching through the cadastral map.

The example of retrieving both cadastral and spatial planning certificates is depicted by means of the use-case diagram, shown in Figure 1 below.

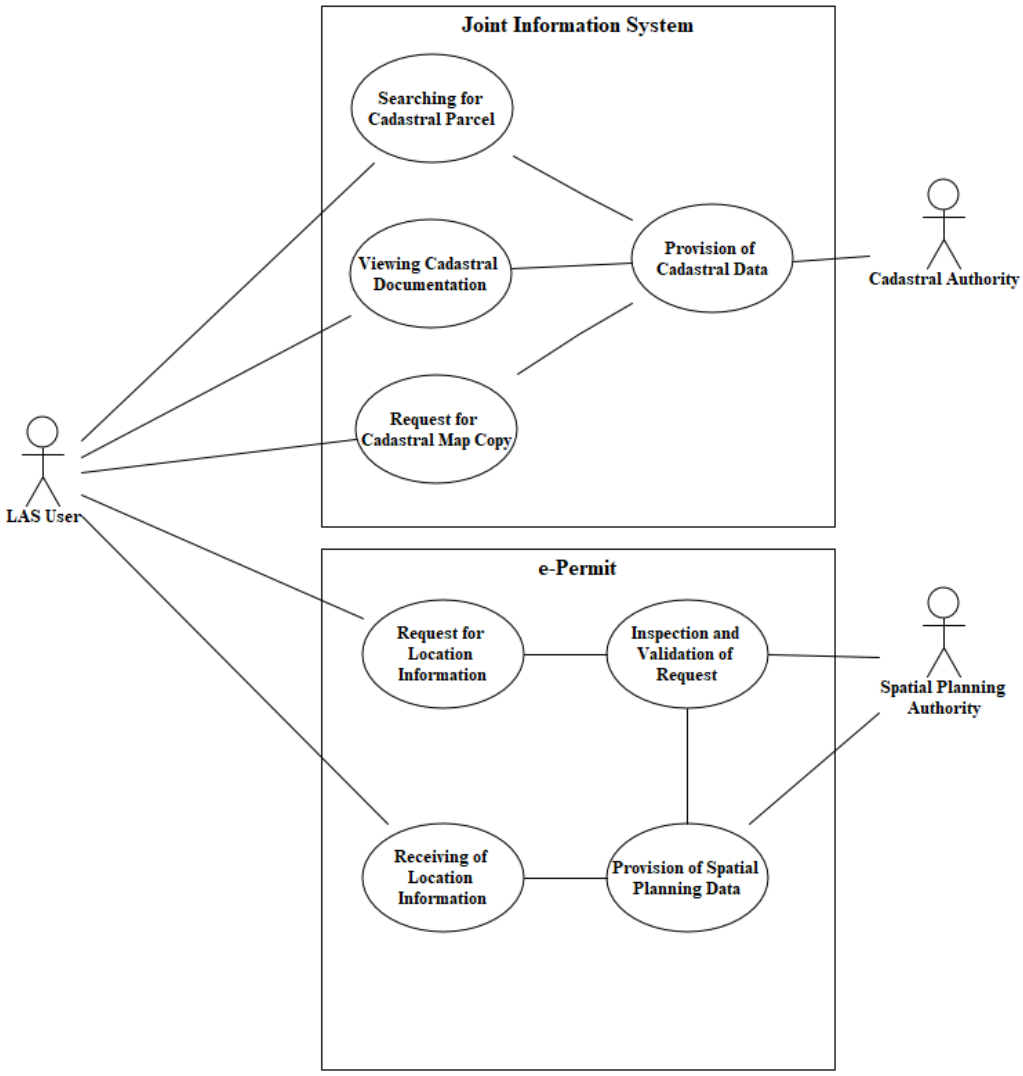

Figure 1. Use-case diagram of cadastral and spatial planning data dissemination process. Source: own compilation

In the use-case diagram (Figure 1), three main actors (stakeholders) of the formalized process were identified, namely the LAS User, and two actors representing different authorities operating within the LAS, namely, the Cadastral Authority and Spatial Planning Authority. Furthermore, the activities conducted by each actor were also identified, although in this case the processes of authorization and registration were omitted, as they are considered to be prerequisites for the execution of the process from the very beginning. The LAS User's activities include searching, viewing, and requesting cadastral or spatial planning data and, finally, receiving the requested certificate. The Cadastral Authority's activity in this case study was the provision of cadastral data, which includes the cadastral system service which enables searching, viewing, and requesting of the data and finally the delivery of requested certificate, or in this case the certificate of the Cadastral Map Copy. On the other hand, the Spatial Planning Authority was in charge of providing access to spatial planning data, although in this case the activities include inspection and validation of the request made by the user, which finally leads to the provision and delivery of the requested certificate, or in this case the Location Information. The Spatial Planning Authority in the examined case study allows for two ways of delivering the requested certificate, namely electronically or via postal service to the address of the user who submits the request. Additionally, it should be noted that the inspection and validation of the request is conducted within the spatial planning authorities whose jurisdiction covers the area where the cadastral parcel of interest is located. Finally, the input and output data sets were also identified, and they include requests made by the LAS User, Cadastral Map Copy and Location Information. Cadastral Map Copy in the first request was the output data, while in the second request it was the input data alongside the submitted request. The process workflow is as follows: the LAS User searches, views, and requests the cadastral certificate via the JIS which is provided by the Cadastral Authority; after the retrieval of the certificate, the LAS User heads to the Spatial Planning authority's service, namely e-Permit, and requests the Location Information, at which point he/she submits the request with personal information and the Cadastral Map Copy. After the request is submitted, the Spatial Planning Authority office receives the request, inspects, and validates said request, and finally delivers the requested Location Information to the LAS User. The timeframe for the described processes is defined by regulations, and the retrieval of cadastral certificates is instant, while the timeframe for executing requests within the Spatial Planning Authority is up to eight days.

The identified elements of the process are shown in Table 1 below, said elements were also matched with the existing LADM classes in order to determine which elements of the examined process are modeled by the LADM and which are not.

Table 1. Process breakdown elements

Process Elements	Identified Elements			LADM Identification
ACTOR	LAS User	Cadastral Authority	Spatial Planning Authority	LA_Party, LA_GroupParty, LA_PartyMember
ACTIVITY	Search, View, Request	Provision	Inspection, Validation, Provision	/
INPUT DATA	Request for Cadastral Map Copy, Request for Location Information, Cadastral Map Copy	Cadastral Data	Spatial Planning Data	LA_Source, LA_SpatialSource, LA_AdministrativeSource
OUTPUT DATA	/	Cadastral Certificates (Cadastral Map Copy)	Location Information	LA_SpatialSource, LA_AdministrativeSource
TIMEFRAME	/	Instant	Up to eight days	/

The identified actors in this process could be denoted using class LA_Party, and its sub-classes LA_GroupParty and LA_PartyMember. This includes users and authorities. The actors might also be referred to as stakeholders in the process, with a clear distinction in their roles. The LAS User is the initiator of the process, while the Cadastral Authority and Spatial Planning Authority actors are considered to be in charge of supervision and execution of the process.

The activities identified in this process are not modeled by the LADM. Despite the fact that these activities are not defined in the standard, they could be denoted as roles of the class LA_Party, the LA_PartyRoleType. Translating activities into role types would result in more clearly defined stakeholders of the process where some stakeholders would have more than one role.

The input and output data concerns the requests made by the user and documents provided by the authorities. Both input and output data could be denoted with class the LA_Source and its sub-classes LA_SpatialSource and LA_AdministrativeSource.

Timeframe could also be considered of great value in process modeling. Timeframe is usually defined by the regulations or in cases where it is not defined by law, could correspond to some type of agreement between the stakeholders in the process. For example, a request for certain data sets could be marked with the time of submission and time of execution of the request, no matter what the outcome of the request is.

Furthermore, the process modeling could also include formats or procedures which take place within the process, such as the format of the input and output data. In this case the requests were in the format of online forms and provided documents were disseminated in PDF format. In the case of LA_Source class this could be denoted as the attribute mediaType.

More in-depth analysis of the process of dissemination of land administration data would require the development of more complex diagrams, such as activity diagrams in which every action, restriction and result would be identified and analyzed.

5. DISCUSSION

The starting point for improving and optimizing land administration dissemination processes might be found in the definition of the spatial information interoperability, which states that the interoperability in the domain of spatial information is the cooperation, as well as the compatibility of an information system to run, manage, exchange and share the data of different organizations related to spatial information on, above and below the Earth's surface; for any kind of application to serve users over networks (Rawat, 2003; Kalantari et al., 2005). From this definition it could be stated that the link between land information data sets provided by different land administration authorities is the key in developing an efficient-to-use system for current and future users of land information.

In this paper, the authors have formalized and analyzed one use-case of land administration data dissemination processes. The examined process includes two online services for dissemination of LAS data operated by different land administration authorities. In the present study, one data set is required to obtain the other data set, where both data sets relate to same unit, namely the cadastral parcel. If the land administration data sets were interoperable, with established geometrical, topological, and semantical relations, the users could retrieve data using only one request within one LAS service. This is where the LADM could step in and provide possible solutions in designing such a system. As is already known, the LADM offers a solution in defining core classes and parts of the LAS, although the LADM is currently in state of being upgraded with other land administration functions, such as spatial planning and valuation (Indrajit et al., 2020; Kara et al., 2021). With future developments it could be possible to develop a national profile for all of the existing land administration functions and merge them within one system or service, similar to the JIS, where cadastre and land book data is connected within one warehouse. From this developed model, it could be possible to develop a single view/document/certificate in which LAS users could choose what land information they need and retrieve the certificate instantly. This, however, would urge the need for development of standardized user profiles as instances of class LA_Party for all stakeholders involved in the process and development of unified land administration excerpt containing parcel/party-relevant land information. An example of the proposed unified parcel certificate, colloquially named Property Deed, can be found in Križanović et al. (2021).

Figure 2 illustrates how the examined data dissemination process would look if the land administration data was stored, provided and interoperable within one LAS service.

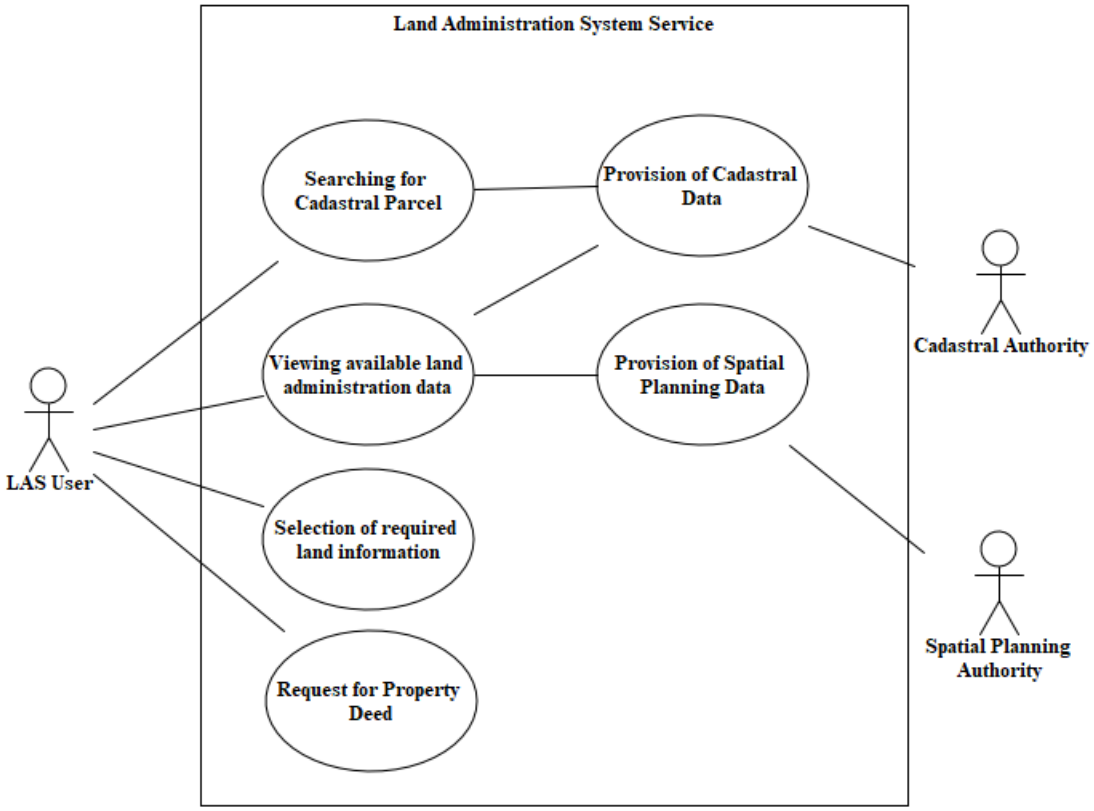

Figure 2. Use-case diagram of Property Deed data dissemination process. Source: own compilation

In the use-case diagram (Figure 2), the LAS User approaches the process of retrieving land administration data within one LAS service, in which the Cadastral Authority and Spatial Planning Authority are in charge of provision of their respective data. In this case, the LAS User must also search for a cadastral parcel of interest, view available land administration data, select the required land information, and, finally, request a Property Deed concerning the cadastral parcel of interest. In this case, the data dissemination could be instant, as there would be no need to inspect and validate the request submitted by the user. Therefore, the validation of the request would be guaranteed were the selected data available or the user's credentials allowed him/her to request the selected data. It could be stated that, in this case, compared to the use-case analyzed in the previous section, it would be more time-efficient and user-friendly to access the disseminated LAS data.

6. CONCLUSION AND FUTURE WORK RECOMMENDATIONS

This paper analyzed one use-case scenario of land administration data dissemination in Croatia. The analyzed use-case scenario was formalized by means of a use-case diagram using the UML. From the formalized process, it was possible to determine the identification of actors, activities, process phases and elements such as input, and output data. The timeframe of the process was also addressed, as in this process it was defined by regulations. Furthermore, the connection of the identified process elements with the existing LADM classes was examined. This resulted in the proposition that the activities of the analyzed

process could be denoted with the role attribute of class LA_Party. Levels 1 and 2 of the proposed process modeling methodology were successfully conducted.

The present paper also discussed the importance of interoperability within existing land administration data sets, as such interoperability may be a prerequisite in building a single service for accessing land administration data. This, however, urges the need for more explicit modeling in a standardized formal manner. Current and future LADM developments could play an important role in optimizing and improving land administration data dissemination processes, as user profiles within a country profile could be developed in accordance with the LADM, while land information certificates and information within them could be derived from classes and attributes modeled by the LADM.

Finally, future work recommendations regarding the land administration data dissemination processes include: the formalization of other use-case scenarios in the processes of land administration data dissemination, and the development of detailed activity and/or sequence diagrams from which a more in-depth process breakdown could be conducted. This approach might lead to the future construction of an improved and optimized model depicting land administration data dissemination processes.

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BIOGRAPHICAL NOTES

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