

PROPOSED MODEL FOR DATA SECURITY PROTECTION OF CADASTRAL INFORMATION IN POLAND

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Summary

The paper presents a proposal for the data security model to protect the cadastral information recorded in the databases of real estate in Poland. The model was developed for the implementation of multi-purpose cadastral tasks. The problem has been considered from the point of view of the smooth functioning of the real estate market. Reliability of the real estate market is guaranteed by the full, accurate, easily available and current cadastral data. The latter is an important piece of information about the area or land, essential for the implementation of most of the real estate management processes. The publication indicates obligatory and optional sources of cadastral information. The basis for the model of cadastral data security system is the compatibility of the assumptions between the said model and the applicable law. The model contains four types of disclosure status for cadastral data (confidential information, public information, incomplete public information, non-confidential information requiring a license). The status was adjusted to specified groups of users of the multipurpose cadastre. The aforementioned groups are based on the entities, acting within the real estate market in Poland. The security model presented herewith assumes a full transition to computer storage media, including the descriptive information and spatial databases, contained in the multi-purpose cadastre, as well as full interoperability of the data collected therein.

Keywords

real estate cadastre • cadastral information • information protection • information security model • multi-purpose cadastre

1. Introduction

The aim of this publication is to present a proposal for a security model of cadastral information, to service the operation of multi-purpose cadastre in Poland. The issues of proper information security, data protection, and the aspect of efficient management of the cadastral database are often raised and discussed both among the users of the system, and in the circles of people and institutions who collectively make up the system. The subject was raised, among other authors, by [Mika 2010]. In the systems analysis of the subject in question, we need to take into account the specificity and

nature of the system itself, and the consequences resulting therefrom. Dawidowicz and Żróbek [2012] are among the authors who have discussed these aspects. It should be noted that the cadastral data have specific requirements as to the geodetic accuracy [Hanus et al. 2014]. There is a constant need for real-time updates of cadastral databases [Bieda et al. 2013] and for sharing the cadastral information in the context of multiple geodetic and legal processes, underpinning real estate management. The problem in terms of the harmonization of cadastral data has been analysed by Maślanka [2016], among other authors. In turn, research conducted by Przewięźlikowska and Buśko [2014] showed that there exists a lot of contradictory information, collected in the Land and Buildings Registry (EGiB) and Land and Mortgage Registry (KW) databases, which constitute the backbone of the cadastre of real estate in Poland. According to Żróbek [2000], in the real estate economy, information is interpreted as land data, collected in order to make certain decisions. For these decisions to be appropriate and effective, the information should be accurate, true, easily accessible, relevant, current, properly describing the area of interest, as well as original and presented in a form that is convenient for the user (recipient). Land information is an integral part of the functioning of each cadastral system. Cadastral information is part of the land information, recorded in cadastral databases, supported by local land information systems. Land and Buildings Registry, which serves as a cadastre of real estate in Poland [Ustawa... 1989], does not provide the users with complete cadastral data. The full cadastral information may be obtained only by using a combination of several different databases. For some years in Poland, work has been underway towards the construction of the Integrated Information System on Real Estate (ZSIN), which should partially solve this problem. Today, however, this system is not yet operational. Cadastral information can be of spatial (graphic) or descriptive character. The degree of informational detail depends on the needs of the cadastral system, and therefore it can include basic data about the property, or more complex information from the range of legal data, data on the location, technical data, planning data and statistical data. Cadastral information may relate to individual properties or groups of properties sharing similar attributes. According to Art. 155 of Real Estate Law [Ustawa... 1997], for the purpose of real estate management process, all data should be used that is contained in both mandatory and optional data sources. Obligatory (compulsory) sources of cadastral information should include the Land and Mortgage Registry (KW), the Land and Buildings Registry (EGiB), the Geodetic Register of Infrastructure Networks (GESUT), the Local Spatial Development Plan (LDP), the Database of Topographic Objects (BDOT), the Prices and Values Register (RCiWN), and in the future, instead of the latter, taxation tables and maps (in Poland, in the course of preparation at present). On the other hand, optional sources of cadastral information may include land information derived from, inter alia, trade or professional information systems, technical and project documentation, inventories held by the Tax Offices (US), databases collected by businesses and insurance companies as well as statistical studies of the Central Statistical Authority (GUS). The databases that record cadastral data contain information about the owners and their rights under the scope of personal data protection. According to the Law on

Personal Data Protection dated 29 August 1997, “Personal data shall mean any information relating to an individual that allows in any way to identify this person. Any operations on these data, i.e. storage, preparation, recording, or sharing may be carried out only with the consent of the person concerned.” At the same time, operating in the real estate market, there are a number of entities, most of which, it seems, should have access to cadastral information. This begs the question: what range of cadastral information (and in relation to which user groups) should be granted the status of full disclosure, and what scope of the information in question should retain the classified character?

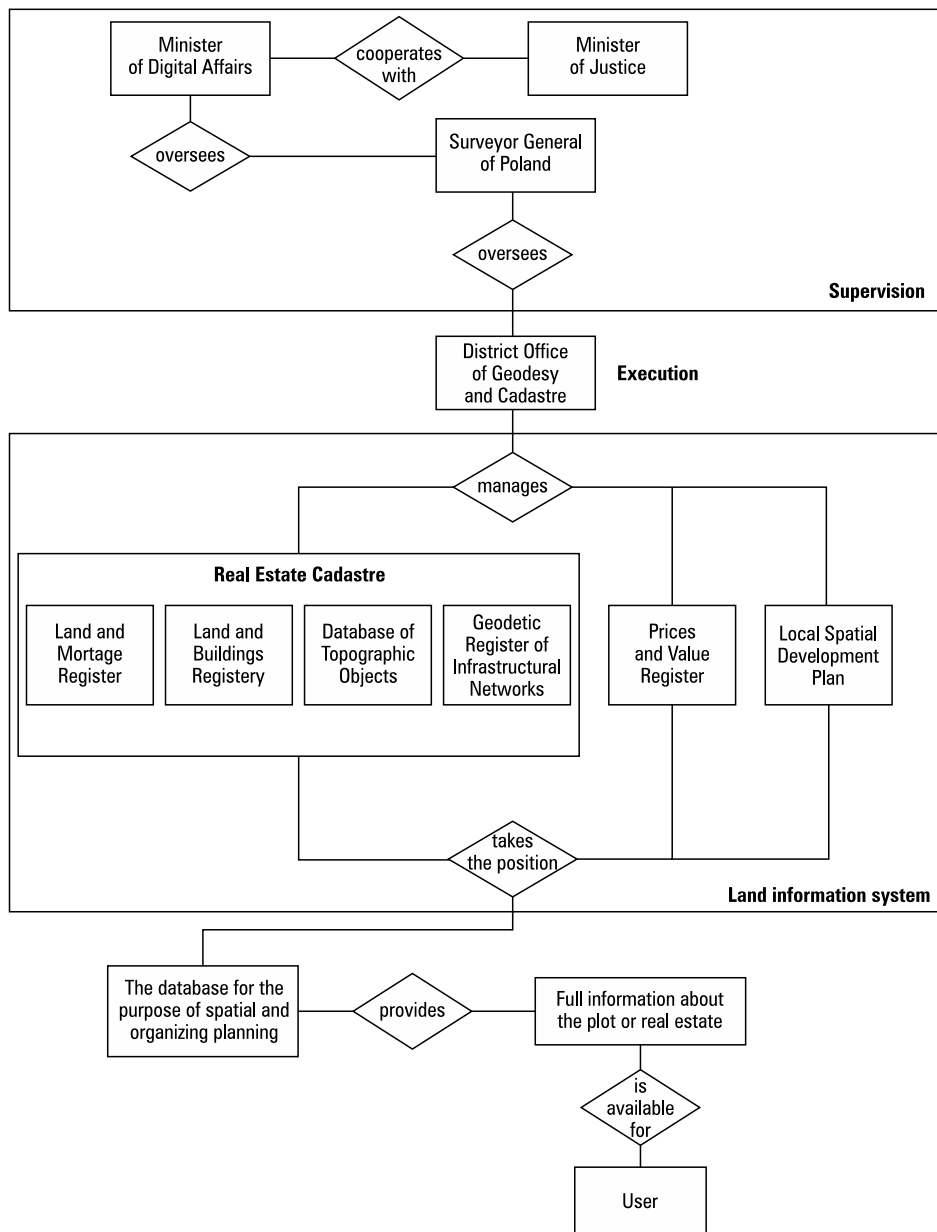
2. Materials and methods

Multi-purpose cadastre, for the benefit of the present study, is the combination of data from the databases, which constitute obligatory sources of cadastral information. Figure 1 shows the original model of the multipurpose cadastre (REC) in Poland, with a structure resembling that of ZSIN, but differing in the scope of the data collected and the way of its management. The leading object of the REC is the real estate property, in its legal and actual sense. According to the Article 46 of the Civil Code [Ustawa... 1964], there are three types of real estate properties:

- Land properties – “parts of the Earth’s surface which constitute the subject of a separate ownership, i.e. a separate property (land)...”
- Real estate properties – “(...) buildings permanently connected to the land (...), if under special provisions they constitute the subject of ownership, i.e. a separate property, which is separate from the land.”
- Premises – “(...) parts of buildings, if, under the specific provisions, they constitute the subject of ownership, i.e. a separate property, which is separate from the land.”

The basis the data security model for the cadastral system thus defined, and presented later in the publication, is to bring the assumptions of the aforementioned model to compliance with all the applicable legal regulations currently in force in Poland, as listed in the references: [Dyrektywa... 2007], [Ustawa... 1989], [Ustawa... 2003], [Ustawa... 1982], [Ustawa... 2010], [Ustawa... 2010], [Ustawa... 2001], [Ustawa... 1997a], [Ustawa... 1997b], [Ustawa... 2005], [Ustawa... 2016], [Ustawa... 1964], [Rozporządzenie... 2001], [Rozporządzenie... 2015a], [Rozporządzenie... 2015b], [Rozporządzenie... 2014], [Rozporządzenie... 2012].

For the purpose of the data security model for cadastral information, the following types of disclosure status were assumed: confidential information (P), public information (J), incomplete public information (JN), and public information on the conditions specified in the license (JL). Confidential information (P) includes personal data or other information that requires protection for security reasons. On the other hand, the information referred to as non-confidential (J) assumes the public right of access to maps and records, upon the justification of legal interest (on principles similar to the currently existing KW). Incomplete public information (JN) concern extracts of



Source: developed based on [Mika et al. 2016]

Fig. 1. The Real Estate Cadastre (REC) model, possible for implementation in Poland. Object of the primary system in the REC should be the 'real estate property'

information from the given data set (e.g. the positioning of N-property in the given taxation zone, without access to the information about the specific value of N). The degree of detail of these data should be adapted to the purpose or the legal interest, in which connection the given entity wants to obtain it, and it should be governed by separate regulations. Public information on the conditions specified in the license (JL) relates to data for the needs of professionals or experts who benefit from the servicing of processes occurring within the real estate market. These individuals, according to the assumptions of the model, are persons of public trust, who possess the appropriate professional qualifications and authority resulting thereof, who provide professional guarantee, and who do not abuse the aforementioned authority under the penalty of deprivation of the right to practice their profession, financial penalty or responsibility. In the case of professional activity for the purpose of surveying, the issue is regulated by Article 48a of the Geodetic and Cartographic Law [1989], which provides that "Whoever uses the materials from the data resources without the required license or in breach of license conditions or provides them contrary to licenses to third parties, is subject to a fine in the amount of ten times the fee for the access to these materials." Access licenses and fees should be determined on a basis similar to the procedures set out in the field of geodesy [Ustawa... 1989, Rozporządzenie... 2014]. Article 40c of the Act [1989] says: "the powers of the entity relating to the possibility of using the released material from the data resources are defined by the license issued by the authority that is providing these materials." Cadastral Information is predominantly derived from the geodetic data resources. Thus, in relation to the cadastral information, we should employ the rules currently applicable in the field of geodesy. Detailed permissions (specified in the license) for the use of materials issued in the digital (electronic) format should clearly define the scope and ability to perform operations on these data and materials. In particular, the scope of rights to their preservation, modification, or sharing should be defined. In turn, for the materials derived from the geodetic data resources, and provided in non-digital formats, we need to regulate the issues of duplication or conversion into the digital format. In any case, the authorized use of materials from the geodetic data resources should generate the obligation to quote the source of the material used. The license should be issued in the electronic (digital) format, and generated by the computerized system to allow the printout that does not require a signature or seal. The rates of fees for making resources available should be subject to annual indexation.

Table 1 proposes a classification of cadastral data, which all together provide full information on the cadastral N (real estate property). It should be noted that of the eight specified types of cadastral information, only two, namely – 3 and 8, do not come directly from the geodetic resources.

Information disclosure status was made conditional on the players in the real estate market in Poland, assuming that each potential owner of the property may be an individual investor in that market. He/she should have access to cadastral information, like the other players in the real estate market, after determining his/her legal interest for the purpose of obtaining information from the database. According to

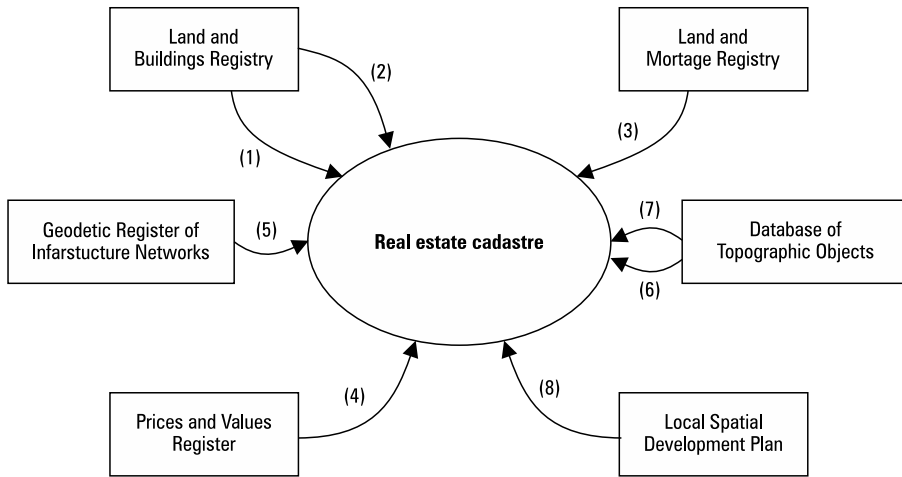
Kucharska-Stasiak [2000], players in the real estate market include: investors, creditors, developers, brokers and technical market service providers (professionals). From the point of view of the present study, it is important to distinguish between two groups of investors: retail (or individual) investors (I-IND) and institutional investors (I-INST). The first group is composed of individuals (natural persons) who invest mostly in real estate for residential or utility purposes. The second group consists of investors with legal personality. A separate group of entities in the real estate market are the creditors (K). The next group comprises real estate development companies (D). It should be noted that this latter group is not uniform. The real estate market includes, on the one hand, the developers-investors (who acquire and build real estate properties), and on the other hand, the developers-speculators, who sell the property objects after their construction. Another group of entities operating in the real estate market are the real estate brokers (M). They deal with bringing together buyers and sellers, for which they receive commission or another form of remuneration. They perform the function of an element that stimulates the real estate market. The last group of players in the real estate market are the professionals, or specialists (S). These include, among others, the geodesy experts, surveyors, appraisers, investment advisors, realtors, architects, designers, lawyers responsible for the legal services market, insurance agents, and property managers.

Table 1. Classification of cadastral information in the data security protection model

No.	Type of information
1	Descriptive information on the actual condition of the N property
2	Spatial information (graphics) on the N property
3	Information on the legal status of the N property
4	Information on the value the N property
5	Information on the infrastructure within the land in question
6	Information on the terrain and land cover
7	Information on the situation of objects within the land in question
8	Information about land use functions and planning intentions

3. Results

The data security model proposed in this publication covers a wide range of cadastral information coming from multiple databases, included in the multi-purpose cadastre (REC). Figure 2 shows a context diagram of the REC in graphic notation of systems analysis according to [Robertson and Robertson 1999], indicating the liminal data flows of different types of cadastral information. Table 2 presents the security model for cadastral information, according to the adopted user groups.



- 1 – flow of descriptive information on the actual condition of the property,
- 2 – flow of spatial information (graphics) on the property,
- 3 – flow of information on the legal status of the property,
- 4 – flow of information on the value the property,
- 5 – flow of information on the infrastructure within the land in question,
- 6 – flow of information on the terrain and land cover,
- 7 – flow of information on the situation of objects within the land in question,
- 8 – flow of information about land use functions and planning intentions.

Source: author’s study

Fig. 2. Context diagram of the REC in the graphic notation of systems analysis, with the demarcation of liminal data flows

Table 2. Data security model of cadastral information, according to the user groups adopted

Type of information/data		Groups of users					
		I-IND	I-INS	K	D	M	S
1	Descriptive information on the actual condition of the N property	P	P	P	P	P	JL
2	Spatial information (graphics) on the N property	JN	JN	JN	JN	JN	JL
3	Information on the legal status of the N property	J	J	J	J	J	J
4	Information on the value the N property	JN	JN	JN	JL	JL	JL
5	Information on the infrastructure within the land in question	P	P	P	P	P	JL
6	Information on the terrain and land cover	JN	JN	JN	JN	JN	JL
7	Information on the situation of objects within the land in question	JN	JN	JN	JN	JN	JN
8	Information about land use functions and planning intentions	JN	JN	JN	JN	JN	JN

Another step in the analysis was to create the data dictionary for the liminal data flows in the graphic notation of systems analysis. The problem is presented in **Table 3**.

Table 3. Data dictionary for liminal data flows, as shown in Figure 2

Name and number of data flow	Description of data flow
1 – Descriptive information on the actual condition of the N property	1 = [for natural persons: name and parents' first and last names, address of permanent residence, nationality, PESEL social security number / in case of death, the information that the person is deceased / for the State Treasury – the name "State Treasury" / for local government units and their associations: the name of the entity or the association, the address of the official seat of the entity or the association / for public administration and organizational units: the name of the authority or the organizational unit, the seat of authority or organizational unit / for other legal persons: the name of the legal entity – full and abbreviated, the address of the seat of the entity, information whether the legal person is foreign] + numerical address (building / flat no.) + no. of cadastral plot + no. *ID* of the register unit (land / building / premises) + no. of registry group + name / ID of the precinct area + name / ID of the cadastral unit + area of the land plot + type of land property + contour area *IDs in Annex 1 to EGiB Regulation of 2016*
2 – Spatial information (graphics) on the N property	2 = No. of the land plot + the coordinates of the boundary points of the plot + boundary lines of the plots + (outline of the building *if there is one on the land in question*) + (premises *if an integral part of the building*) + contours of the land / classification contours of the land *other information from the EGiB numerical map*
3 – Information on the legal status of the N property	3 = KW number + first and last name (of the Owner / Perpetual User / entities recorded together *with a record of the share in ownership*) + inventory of property rights + encumbrances and claims *if they are presented in section III of the KW* + mortgage *if it is shown in section IV of the KW*
4 – Information on the value the N property	4 = the market value of the N property *based on the data from the RCiW until general taxation is introduced, and cadastral value replaces the market value*
5 – Information on the infrastructure within the land in question	5 = cable type *values adopted according to the dictionary of GES_RodzPrzewodu* + the course of the cable *values according to the dictionary of GES_Przebieg* + function of the cable *values according to the dictionary of GES_Funkcja* with GESUT category of object classes of <i>SU infrastructure utility networks</i> , including the following classes of objects: SUPB petrol cable, SUPC heating energy cable, SUPE power cable, SUPG gas line, SUPK sewage pipeline, SUPN oil pipeline, SUPT telecommunications cable, SUPW water supply pipeline, SUPZ unidentified cable, SUPI other line, SUOP pipe or cable casing, SUBP underground structure, SUUS technical device connected to the network, SUPS point at a certain height, SUSM pole and mast, SUKP transmission corridor* + cable specifications
6 – Information on the terrain and land cover	6 = the type of point + top altitude (takes the values with the precision up to 0.10 m for a natural point of altitude, and with the precision of 0.01 m for an artificial point of altitude) + bottom altitude (takes the values with the precision of up to 0.01 m for an artificial point of altitude) *Class cat

<p>6 – Information on the terrain and land cover</p>	<p>egory of objects BDOT500 <i>RT terrain</i> represented by the class of objects RTPW point at a certain height* + Category of object classes BDOT500 <i>PT land cover</i> encompassing the following classes of objects: PTWP surface water, PTRW ditch, P TTL woodland, trees or shrubbery, PT TU area of permanent crops or lawn, P TCM cemetery + Category of object classes BDOT500 <i>BU buildings and infrastructure</i> encompassing the following classes of objects: BUBI engineering structures, BUBH hydrotechnical structures, BUBS sports buildings, BUBT tall technical structures, BUZT technical reservoirs, BUUD road, rail or water reinforcements, BUBZ earthen structures, BUUT transport infrastructure, BUIB other buildings + Category of object classes BDOT500 <i>KT communications and transportation</i> consisting of the following classes of objects: KTJZ road, KTPL square, KTCR path of pedestrian and bicycle traffic, KTUL street, KTKR curb, KTTR track, KTPR crossing, KTOK object associated with transportation + Category of object classes BDOT500 <i>OB other objects</i> encompassing the following classes of objects: OBOP natural object, OBOO landmark of orientation in the field, OBMO wetland, OBSZ rushes</p>
<p>7 – Information on the situation of objects within the land in question</p>	<p>7 = information about the spatial location of objects in the current national spatial reference system (flat rectangular coordinates of geometric middle points for point objects / breaking points for linear and surface objects) + characteristics of the objects using the attributes, according to the data model for BDOT500 *specification in Annex 2 to the Regulation of 2015*</p>
<p>8 – Information about land use functions and planning intentions</p>	<p>8 = function + land use designation *information from the MPZP range* / in case the latter is lacking, information from the SUIKRG range / WZ data</p>

Where: EGIB – Land and Buildings Registry, GESUT – Geodesic Registry of Infrastructure Network, BDOT500 – database of topographical objects, MPZP - local spatial development plans, SUIKZP – studies of conditions and directions of spatial management of the municipality, WZ – decisions on land development conditions and building permits, RCiW – prices and values register, KW – Land and Mortgage Registers

Table 4 lists the terminology needed to create the data dictionary shown in Table 3.

Table 4. List of operators used when developing the data dictionary in the systems analysis methodology

Operator’s symbol	Operator’s significance
=	Is composed of
+	and
[X/Y/Z]	Selection of element X or Y or Z
{.....}	Repetitive elements
(.....)	Optional
.....	Comment

Source: developed based on [Robertson and Robertson 1999]

4. Conclusions

The present publication highlights the essential aspect of the modern real estate cadastre, which is to protect the cadastral information gathered therein. The data security model, as presented, assumes free flow (exchange) of information between different the systems forming parts of the databases, which are the components of the modelled multi-purpose cadastral system (REC). The system introduces the status of cadastral information disclosure, depending on the groups of potential users thereof – who simultaneously operate as subjects in the real estate market. The presented data security protection model assumes a full transition to computer storage media in the field of descriptive information and spatial data, of all the databases included in the REC, as well as full interoperability of the data collected therein. The model presented herewith seems to be feasible to implement in Polish conditions, provided some modifications to the regulations of law. A proposal for some changes in the law for the purposes of real estate cadastre has already been presented by [Mika 2016].

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