



## QUALITY OF LAND RECORDS DATA IN THE CONTEXT OF ANALYSING ELECTRONIC DATA EXCHANGE

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### Summary

The boundaries of land-records plots are shown in the real estate cadastre on the basis of documentation created as a result of geodetic and legal activities, connected with determining the location of existing border points. The course of land plots' boundaries should be considered in the aspect of technological and legal space. This implies the need for an analysis of the problems accompanying the implementation of standards for electronic data exchange (EDI) of land-register data, and the validation process in the context of the quality of these data. The example is provided by two standards for the land records EDI: SWDE and GML.

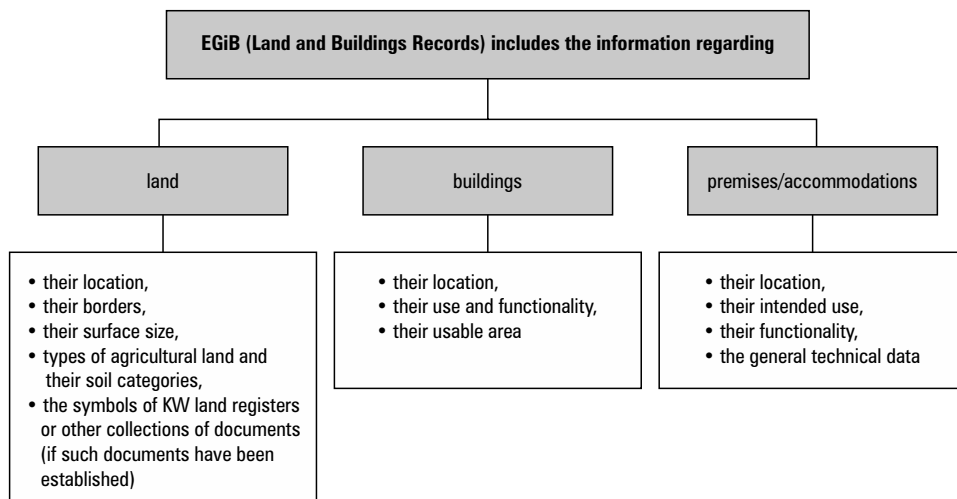
### Keywords

real estate cadastre • electronic data exchange (EDI)

### 1. Introduction

Real estate cadastre constitutes public records, whose objective is to provide unique identification of land-plots (parcels) in space. In conjunction with the land and mortgage register, it guarantees protection of ownership, giving each entity the possibility to manage their real estate and the rights assigned to it. It also defines the limitations to the execution of these rights [Felcenloben 2009]. In real estate management and trading, certainty as to the rights possessed, as well as the range of those rights, is a timeless value of great importance. Each owner or usufructuary, who is holding a legal title to the real estate, should have certainty as to the data disclosed in public registers and records, and therefore disclosed in the Land and Buildings Records [Litwin and Szewczyk 2012], including the indicated area of registered plots, the usable floor area of the building or the premises, the current manner of land management therein, and so forth (Figure 1).

Data disclosed in the land and building records, available by right to entities, exert a huge influence on the public and legal order. This is evidenced by the transaction price of the property, the rate of rent or lease on the property, the amount of tax, or even the value of fees for excluding the given plot of land from agricultural production, referred to as “farmland conversion”, as indicated by Baciór [2010], among others.



Source: Rozporządzenie [2001]

Fig. 1. Information included in the Land and Buildings Records

## 2. Subject of the study

Building and maintaining an effective property management system depends to a large extent on the institutional efficiency of keeping the real estate cadastre [Felcenloben 2015]. However, this is not the only component ensuring the possession of an efficient and effective data management system for real estate property. In times of globalization and the growing demand for information, which becomes one of the basic goods and resources of the information society [Dyrektywa 2007], one should note the necessity of having data of the required credibility and quality. Such a society, which treats information as a special type of intangible asset, pays particular attention to the development of services related to data transmission, processing, and storage. An important technological solution that increases the capacities of effective information flow is the use of Electronic Data Exchange [Siejka i in. 2014]. The assumptions resulting in the creation of ICT databases [Rozporządzenie 2013] make it necessary to use the Just in Time concept [Lock 2002] in the processes related to operations on data, that is to provide the necessary required amount of data with the highest quality possible.

Saving time constitutes the main benefit of this type of solution, but there are also other advantages, associated with the minimum work required to generate data based on a precisely and clearly defined query. According to this concept, all data is stored only in the digital format. It is worth noting that the amendment of the Surveying and Cartographic Law [Ustawa 1989] from this year once again extends the deadline for the digitization of the resource. This makes it possible to create a system in which the collected data can be selected from the given IT layer in an instant. In real estate

management processes, the constructed system has an impact on the effectiveness of geoinformation services, and (taking into account the functions performed by the land records) also on the effectiveness of State administration, whose goal should be to support a sustainable, effective and efficient real estate market [Szczepaniak and Wojewik-Filipowska 2014].

### 3. Assessment of geodetic and cartographic resources – evaluation criteria

Taking into account the fact that the property cadastre constitutes public records, one should strive to create a uniform national cadastral assessment system [Felcenloben 2015] taking into account the following criteria:

- a) Performance, by which one should understand the efficiency of the information system, that is, the evaluation of the achieved results in the context of the intended purpose of the operation. The term performance also includes the timeliness of handling the matters and enquiries, therefore it is necessary to take into account the human factor, such as the level of employee competencies, which also translates into the quality of services provided,
- b) The quality of registration data, which is a concept encompassing the following:
  - technical quality of the manner of maintaining the records, in accordance with the new regulations [Ustawa 1989, Rozporządzenie 2001], in the form of object-relational databases,
  - completeness of data, guaranteeing the compliance of the state disclosed in the register with the current legal status,
  - up-to-dateness of databases, that is the assessment of an existing inventory of information in the record, carried out in on-going verification processes, or during tasks related to the modernization of land and buildings,
  - reliability conformed by verifying the data which makes up the information on the border points of land plots, and the required accuracy assumptions in the process of “creating” registration boundaries, including the analysis of BPP, ZRD, and STB attribute information, in the context of legislative changes, and the need to recalculate the points. So far, there are no legal regulations defining a set of attributes that could be regarded as reliable.
- c) Commercial capacity, which should be understood as the possibility of optimizing the solutions of the existing cadastre service system. When assessing documentation centres, whose structures are integrated within the work of administrative bodies, the commerciality test should be carried out only in the above aspect, separating it from the so-called cost effectiveness and thus distinguishing from a company (a business) that should generate particular revenues.

The assessment of the geodetic and cartographic resources should be referred directly to the manner in which the cadastral data were included in the resource, and how they were controlled or verified at the stage of accepting the materials into the data resources. The subject matter under consideration is therefore to the standards of

electronic data exchange for land and buildings registration data, as they were created over time. The following formats of electronic data exchange have appeared in Poland over the past 20 years [Bydłoz 2006]:

- a) TANGO was developed in 1998 in order to supply data to geodetic documentation centres. The format uses a vector model, whereas spatial features are transmitted in the form of points, lines, areas, or texts. Additional data is contained in text files, and that includes a geodetic coordinate system, date, surface area, and so on.
- b) SWDE/SWING SWDE format was established legally in 2001 by Annex 4 to the Regulation on the Land and Building Records [Rozporządzenie 2001] and was subsequently modified several times, including in 2003, and once again in 2006. It should therefore be noted that modifications, which introduced changes to the data exchange standard caused the originally adopted data to contain some inaccuracies or errors in relation to the new legal status. Constant modifications have led to the creation of a new SWING standard, which, however, has never been a formally binding norm. The SWDE standard is now formally disused, however, due to problems with the already existing new standard, the practice of reporting the data in this previous standard remained (and still remains) not uncommon.
- c) XML / GML is the current standard for the recording of geographic information. The basis for the GML document is the record of the set of objects. GML provides tools for the description of objects, containing information about the coordinate system, about their geometry, topology, time, and generalization level.

Due to the fact that the TANGO format is now virtually obsolete, it has been omitted by the author of the present publication in the context of examining the quality of the possessed data. Another reason for such a decision is the natural replacement of the previously created data with the new data compliant with the more recent standards [Instrukcja techniczna 2003].

#### 4. Analysis based on source data

The problem of assessing land and buildings records' data from a purely technical point of view can be much more difficult than it might have seemed originally. As the standard for the exchange of registration data, SWDE has been equipped with two data validation tools, released and recommended by GUGiK, namely A-SWDE and the Reporter software programs<sup>1</sup>, which the author of the present publication used when auditing the file T4-02-120616\_2.0006.swd for the area of the Zabierzów municipality.

Using the A-SWDE software, the author performed syntactic check (control of the attributes, file sections, records), and semantic check (control of the correctness of the relationship). After the syntactic and semantic check, he also authorized and verified the checksums contained in the SWDE file. The results of the syntactic check of the file did not show any errors, while the semantic check returned the following errors:

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<sup>1</sup> Published in connection with ARiMR operations.

“Type: G5DZE. Warning (error) code: 3003 – number of occurrences: 1

Type: G5GRP\_DZE. Warning (error) code: 3001 – number of occurrences: 1

Type: G5OBR Warning (error) code: 3003 – number of occurrences: 1”

To recapitulate the control process as a whole, it should be noted that the message defined in code 3001 is a warning, whereas the information with code 3003 should be treated as an error caused by the lack of an attribute definition in accordance with the regulation (Figure 2).

CODE	TYPE	DESCRIPTION	NAME	ATR 1	ATR 2
3001	O	Additional application type %s – missing in the annex	ecSTExtraRecType	name of record type	
3002	B	Base type of %s record not compliant with the annex	ecSTInvalidBaseRecType	name of record	
3003	B	Required %s attribute missing in the definition of the %s type – lack of compliance with the annex	ecSTAttrMandatNotExists	name of attribute – code	name of type
3004	B	Required %s binding is missing in the definition of the %s type – lack of compliance with the annex	ecSTRelatMandatNotExists	name of binding – code	name of type
3005	O	Definition of the %s record type is missing from the ST section	ecSTRecTypeNotExists	name of record type	
3006	B	Faulty multiplication of %s relationship in the definition of the %s type	ecSTInvalidRelatMultiple	relational code	name of type
3007	O	Additional %s attribute in the %s definition of the application type	ecSTExtraAttr	name of attribute	name of type
3008	O	Additional %s relationship in the %s definition of the application type	ecSTExtraRelation	name of relationship	name of type
3009	B	The %s attribute is not declared in the SP section	ecSTAttrNotDeclaredInSP	name of attribute	
3010	B	The %s relationship is not declared in the SP section	ecSTRelatNotDeclInSP	name of relationship	
3011	B	Multiple occurrence of the %s binding in the definition of the %s record type	ecSTMultipleRelatDecl	name of binding or name of field	name of type
3012	B	Multiple occurrence of the %s attribute in the definition of the %s record type	ecSTMultipleAttrDecl	name of attribute or name of field	
3013	O	Multiple occurrence of the %s record definition	ecSTRecTypeDeclBefore	name of record type	
3014	I	Type definition section (ST) is missing	ecSTNoSectionST		

Source: A-SWDE

Fig. 2. Section of definitions and types for the program

The next check was carried out using the Reporter software. The program categorises errors according to their type, dividing them into critical, non-critical, and negligible errors.

Below is an example of four repetitive critical errors thrown out by the program, one non-critical one, and a dozen or so negligible errors, along with the author's commentary written in red (Tables 1, 2, and 3):

**Table 1.** Critical errors

Identification symbol of the SWDE object	Level	Description of error	COMMENTS
File no. T4-02-120616_2.0006.swd Lines: 16	Data context section	Faulty name of coordinate system	DEFINED CORRECTLY according to annex 6 FOR THE SWING 3.0 FORMAT
File no. T4-02-120616_2.0006.swd Lines: 22	Section	Faulty CRC sum	FAULTY CONTROL NUMBER FOR BINARY DATA

Source: author's study

**Table 2.** Non-critical errors

Identification symbol of the SWDE object	Level	Description of error	COMMENTS
File no. T4-02-120616_2.0006.swd Lines: 237, 244, 329, 330	File	Characters non-compliant with the SWDE standard (for instance, wrong code page)	POLISH DIACRITICS TURN TO #

Source: author's study

**Table 3.** Negligible errors

Identification symbol of the SWDE object	Level	Description of error	COMMENTS
File no. T4-02-120616_2.0006.swd Lines: 597, 611, 625, 639, 653, 667, 681, 695, 726, 740, and 226 others	Turn point of the border	Missing attribute G5BPP – POINT LOCATION ERROR	VALUES OF ATTRIBUTES ARE MISSING
File no. T4-02-120616_2.0006.swd Lines: 597, 611, 625, 639, 653, 667, 681, 695, 726, 740, and 226 others	Turn point of the border	Missing attribute G5STB – STABILISATION CODE	VALUES OF ATTRIBUTES ARE MISSING
File no. T4-02-120616_2.0006.swd Lines: 5243	Document	Missing attribute G5DTP – DATE OF ENTERING INTO THE RECORDS	VALUES OF ATTRIBUTES ARE MISSING

Source: author's study

## 5. Summary of results

As it is fairly evident, the control of identical files carried out with two independent software programs (both recommended by GUGIK) shows different errors. Another important issue is the fact that when trying to import data into any kind of software (C-geo, Ewmapa) that supports this electronic data exchange standard, the data is imported without indicating any errors. This state of affairs may give rise to a justified concern as to whether the inspections by contractors of works, as well as their recipients/beneficiaries, had been carried out properly and correctly as to their substance. The reason for the occurrence of many discrepancies, and at least several file validation programs, was the constant modification of the standard, at some point causing a situation in which it was possible to obtain conflicting or even mutually exclusive reports based on the same data.

The next analysed electronic data exchange standard is the GML. Based on the analyses we have conducted, it should be stated that this standard is not free of errors and, just like its predecessors, it is subject to continuous verification during the implementation of various projects that reveal many oversights and errors. The result of the author's validation of the 120616\_2.0006.GML file (Figure 3) combined with the analysis of the law [Rozporządzenie 2001] for the Zabierzów municipality, are the following observations:

- a) The large size (volume) of the data file, with very little "legibility" of the model, results from the fact that the GML scheme (i.e. chapters) is repeated multiple times;
- b) The lack of transferability of some editorial elements of the map; therefore time spent by the developer on editing the maps can be considered as lost;
- c) The functioning of the model in theory resulted in the inability to refer it to practical solutions (Figure 4). The problem concerned buildings in particular, specifically the need to assign them with attributes that were initially not defined. In the past, this led to situations that may be described as bizarre, to say the least. In extreme cases it caused skipping certain objects whatsoever, or in the case of the need to accept, it led to filling in the blanks with false data. Currently, the problem is being solved, by replacing the critical error with a non-critical error.
- d) Unclear wording: existence of two definitions of address – one being the "address of the building" and the other, "address";
- e) Publication of the GML scheme in the text of the regulation – this causes chaos and excessive expansion of the executive act;
- f) Another case, also confirmed by the analysis of Izdebski's publication [2013], consists in the lack of formulation of unambiguous definitions of the existing objects (Figure 4).

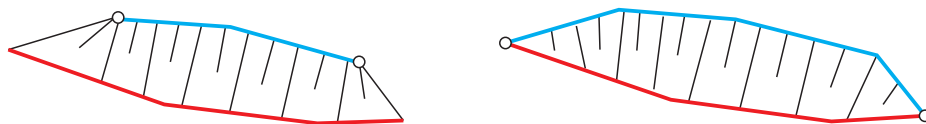
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type="egb:EGB_RodzajWgKSTType"/>
<element name="lacznaPowUzytkLokaliNiewyodrebnionych"
type="gml:AreaType" minOccurs="0"/>
<element
name="lacznaPowUzytkowaLokaliWyodrebnionych" type="gml:AreaType" minOccurs="0"/>
<element
name="powierzchniaUzytkowaBudynkuZObmiarow" type="gml:AreaType" minOccurs="0"/>
<element
name="powierzchniaUzytkowaBudynkuWgProjektuBudowlanego" type="gml:AreaType"
minOccurs="0"/>
<element
name="powierzchniaUzytkowaPomieszczenPrzynalecznychDoLokali" type="gml:AreaType"
minOccurs="0"/>
<element name="dodatkoweInformacje" type="string"
minOccurs="0"/>
<element name="rokZakonczeniaPrzebudowy"
type="positiveInteger" minOccurs="0"/>
<element name="wiekZakonczeniaBudowy" type="integer"
minOccurs="0"/>
<element name="wiekZakonczeniaPrzebudowy"
type="integer" minOccurs="0"/>
<element name="zakresPrzebudowy"
type="egb:EGB_ZakresPrzebudowyBudynkuType" minOccurs="0"/>
<element name="stopienPewnosciUstaleniaDatyPrzebudowy"
type="egb:EGB_ZrodloDatyBudowyType" minOccurs="0"/>
<element name="georeferencja"

```

Source: Rozporządzenie [2001]

Fig. 3. Fragment of a building's description



Source: Izdebski [2013]

Fig. 4. Embankment with an identical shape and varying graphic presentation

## 6. Conclusions

Polish law does not currently guarantee reliable record of the location of points and the course of boundary lines. Therefore, there are cases where the boundaries of plots come from vectorization, and the points created in this way are characterized by lower accuracy. When analysing the available cadastral data as well as the electronic data exchange standards, it should be noted that:



1. Electronic data exchange, applicable in the case of land and building records data, despite its defects, increases the efficiency of information processing during the implementation of European directives, including INSPIRE.
2. The analysis of individual cases and experiences shows that despite the existence of several formats, as well as several varieties of SWDE, GML formats, none of them guarantees the exchange of land and building records data while maintaining faithful content as it is recorded in the original database, and that there is no possibility of importing or exporting data while retaining all the editorial elements of the numerical map.
3. The lack of a uniform data evaluation system, combined with the presence of different validation programs, results in varying results of the assessment of land and building records data.
4. Before introducing any new data standard, a detailed and substantive assessment of such a standard should be made, using real data. Implementation based on theoretical assumptions causes deficiencies, which are supplemented and updated, and that in turn is the reason for the creation of chaos. The model should be tested on real data in as many cases as possible.

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