

## GENERAL PROBLEMS OF THE CADASTRE SYSTEM – CASE STUDY IN POLAND

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### ABSTRACT

**Motives:** The proper functioning of land administration systems guarantees the security of property rights and property trading rights, which is why many countries worldwide are carrying out continuous research aimed at harmonising and modernising the cadastral system.

**Aim:** The aim of this article is to show the effects of the implementation of the global concepts of the cadastral system evolution under Polish conditions. This problem is international in nature, and common for a group of central and eastern European countries that underwent a systemic transformation at the end of the 20th century.

**Results:** As demonstrated in the case study, the cadastral system maintained in Poland is not uniform. There are still many areas where the basic source of information about properties is the materials from the 1960's and 1970's. Nevertheless, the gradually conducted modernisation of the Land and Buildings Registry, which is based on international standards and norms, is slowly leading to the establishment of a full-fledged cadastral system.

**Keywords:** cadastre modernisation, cadastral data quality, types of errors in cadastral documentation

### INTRODUCTION

At the end of the 20th century, cadastral systems were revolutionised. The development of information technology (IT) tools has generated advances in the spatial information technology. The need to implement the principles of sustainable development has resulted

in the development of new visions, models, and roles for the cadastre. As reported by Bennet et al. (2010, p. 2): “Innovative concepts and seminal documents including the Multipurpose Cadastre (Williamson, 1985), FIG Statement on the Cadastre (FIG, 1995), The Bogor Declaration (FIG 1996), The Bathurst Declaration (FIG, 1999), Cadastre 2014 (Kaufmann

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& Steudler, 1998), the Core Cadastral Domain Model (van Oosterom et al., 2006), and the Land Management Paradigm (Enemark et al., 2005) radically altered understandings of the cadastre and its potential. Practical implementations can now be seen in the land administration systems of both developed and developing countries”. This claim was confirmed by the studies conducted by Lemmen et al. (2013), and Lemmen et al. (2015).

The abundance of applications for the cadastre were also presented by Ting and Williamson (1999). In their studies, they highlighted the role of a multi-purpose cadastre in the development and operation of land administration systems.

In recent years, the concept of a multipurpose cadastre has been aimed at extending the cadastral data dimension from 2D to 3D, or even, as suggested by certain authors, to 4D (Siejka et al., 2014). Therefore, the cadastre of the 21st century should not only be a multi-functional but also a multi-dimensional system for collecting property data (Bydłosz, 2012; Karabin, 2012; Mika, 2018). A similar function of the cadastre was presented at the FIG Congress in 2022, with the emphasis that effective data verification and regular updating are essential in land management (Kocur-Bera & Pietrulińska, 2022). Attention was also drawn to the compatibility of the data contained in the Land and Mortgage Register and the cadastre as a key element confirming the quality of data collected in these systems (Karabin & Łuczyński, 2022).

The cadastre, particularly in south-east European countries, has evolved over many decades under different historical, legal, and technological conditions. The data contained in cadastral documentation can be, and often are, unreliable (Hanus et al., 2018; 2020; 2021). Similar problems occur in neighbouring European countries with the historical roots shared with Poland, such as Slovakia (Muchowa & Juskowa, 2017), Croatia (Tomić et al., 2018), or the Czech Republic (Pesl, 2003). Another problem that aggravates the lack of consistency in the cadastre is the political transformation which took place after the Second World War. This situation applies to most of the Baltic countries (Mika, 2018; Parsova et al., 2012; Pesl

& Slaboch, 2002). In Poland, the principles of market economy functioning were restored only after 1989. In accordance with the regulations in force, the role of the cadastre is served by a database functioning under the name of Land and Buildings Registry (status as of 2020). This is a public register which collects descriptive and spatial data on cadastral objects i.e. land parcels, buildings, and premises<sup>1</sup>. Unfortunately, this system does not guarantee the unambiguous identification of cadastral objects in legal terms. Only when combined with the information contained in a separate system that functions in Poland under the name of Land and Mortgage Register<sup>2</sup>, it is possible to determine the actual legal and factual status of these objects. These two separate registers are maintained by institutions which are subordinate to two different Ministries. This results in the number of errors and uncertainties as regards the compatibility of cadastral data. Information on cadastral objects is duplicated in both registers and, unfortunately, there are cases of incompatibility of data concerning the same property, which are registered in both systems. An additional problem associated with the mutual exchange of information between these registers is the varied territorial range of data collection. The Land and Buildings Registry collects data within the so-called cadastral unit, which is most often a commune or municipality. As regards the Land and Mortgage Register maintained by District Courts, the area of data collection is the so-called area which most often does not overlap with the administrative boundaries of communes and their subordinate smaller territorial units (the so-called districts, which most often are villages in the case of communes, or districts in the case of cities). This issue was addressed *inter alia* in (Dawidowicz et al., 2014; Hanus et al., 2014; Ilyushina et al., 2018; Maślanka, 2019; Mika, 2017b; 2018; Parsova et al., 2012; Wilkowski & Karabin, 2006). Also, the boundaries of the smallest territorial units registered in both systems, which are at the same time basic cadastral objects, do not

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<sup>1</sup> Available at <https://www.geoportal.gov.pl>

<sup>2</sup> Available at <https://ekw.ms.gov.pl>

overlap in the field. As regards the Land and Buildings Registry, the basic object is a land parcel, and for the Land and Mortgage Register, the basic object is a land, building, or premises property. According to Article 9 of Resolution of the Minister of Regional Development and Construction of 29 March 2001 on the Land and Buildings Registry: “A cadastral parcel is a continuous area of land situated within the boundaries of one district, legally homogeneous and separated from the environment with boundary lines”. On the other hand, according to Article 46 § 1 of the Civil Code Act of 23 April 1964, “Real estate is part of the earth’s surface constituting a separate object of ownership (land), as well as buildings permanently attached to the land or parts of such buildings if, under specific regulations, they constitute an object of ownership separate from the land.”

In the last 30 years, there has been a noticeable drive in Poland to modernise the cadastral system by means of successive amendments of regulations in accordance with the global trends in the construction of cadastral systems. The authors who have addressed this issue include (Buśko, 2017; Dawidowicz & Żróbek, 2011; Mika, 2017a). As reported by (Aleksic et al., 2010; Bennett et al., 2010; Hanus et al., 2014; Inan et al., 2010; Kocur-Bera & Frąszczak, 2021; Noszczyk & Hernik, 2019) an efficiently functioning system enables the development of the real estate market while being a source of data for a wide group of users. Above all, it guarantees stability in the real estate market under market economy conditions. The recent amendments to the Land Surveying and Cartographic Law Act of 17 May 1989, were aimed at streamlining the investment and construction processes, and introducing an obligation to establish spatial databases for spatial planning acts. A similar aim guided the update of the Regulation on the Land and Property Register of 27 July 2021. As compared to the previously valid legal act on land register, it was considerably shortened while retaining the most important provisions concerning the functioning of the cadastre. Therefore, the cadastre reforms aim at extending the use of cadastral databases.

The concept of a multi-purpose cadastre is based on the assumption that a cadastral register can serve multiple different purposes. It combines the physical, legal, and economic aspects of the cadastre. The physical aspect is closely linked to data on land and buildings. The legal aspect concerns the scope of ownership and the rights to a particular property. The economic aspect governs the issues related to the property value, which, within the meaning of international trends in cadastre construction, is part of the fiscal cadastre. Additionally, a new function of the cadastre, the so-called Green Cadastre, is emerging in scientific papers (Dawidowicz et al., 2020). Green Cadastre assumes the establishment of a uniform system designed to monitor agricultural land in support of agricultural policy.

The aim of this article is to show the effects of the implementation of the global concepts of the cadastral system evolution under Polish conditions. This problem is international in nature, and common for a group of central and eastern European countries that underwent a systemic transformation at the end of the 20th century. As shown by the conducted references review, as of the date of publication of this article, there are no studies on the actual state of the cadastre in these countries. This article is the next step in a scientific discussion on the development of the cadastre in Europe. The research questions posed below relate to Polish conditions but they are universal enough to be used to assess the cadastre in other countries. Does the cadastral data quality in Poland meet global standards? How was Polish cadastre evolving in individual years of the implementation of the assumptions of major cadastre development scenarios worldwide, such as CADASTRE 2014 and CADASTRE 2020? Have the attempts made to modernise the cadastre yielded the expected results? How does the cadastre in Poland function, and what problems does it encounter in the year 2022?

Further part of the article will analyse the vision statement of cadastral systems under Polish conditions.

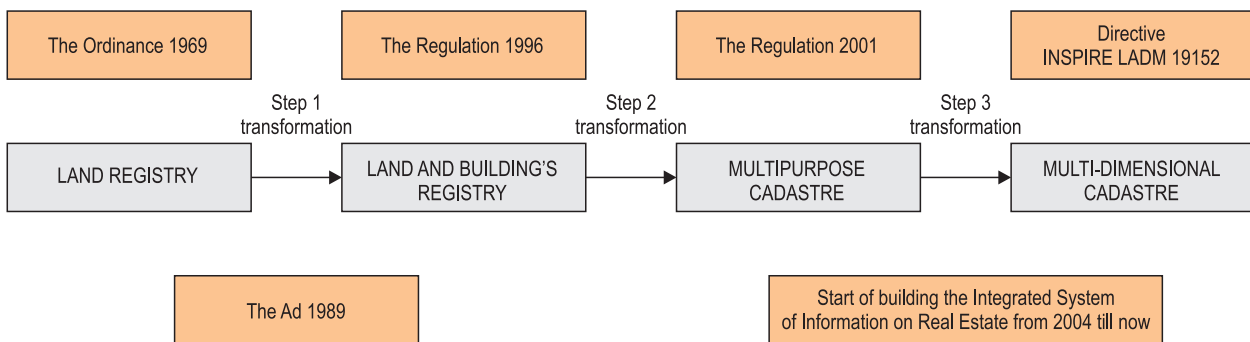
## ANALYSIS OF THE DEGREE OF IMPLEMENTATION OF GLOBAL TRENDS IN CADASTRE CONSTRUCTION IN POLAND

From the perspective of the subject matter addressed in the study, the following essential documents, legal acts, and implementing provisions, both international and national, were examined: the vision of CADASTRE 2014, the vision of CADASTRE 2020, the INSPIRE Directive, ISO 19152 (LADM), the Land Surveying and Cartographic Law Act, Resolution on the Land and Buildings Registry of 2001, and the Act on spatial data infrastructure.

In the first place, the assumptions of the statements of CADASTRE 2014 were analysed. Due to the need to modernise the cadastre, the International Federation of Surveyors (FIG), via Commission 7, established the Working Group 7.1 at the Congress in 1994. A scope of tasks was defined for them. It was proposed to introduce a cadastral reform along with the procedures for gradual data automation. The cadastral system being modernised was given a new, much more responsible role, laying the foundations for the comprehensive land information system (Kaufmann & Steudler, 1998).

As reported by Kaufmann & Steudler (1998) and Kaufmann (2002), during the research into the current state of cadastral systems, it appeared that the documentation and registers concerning private land were not able to provide sufficient information

to be able to present a complete picture of the legal situation of land. In many European countries, the legal sphere has changed noticeably over the last few decades. New regulations have been introduced to ensure prudent use of land and other scarce resources. Based on the research conducted by the author, certain conclusions were drawn as to how cadastral systems should be constructed. Firstly, they need to be a source of reliable and complete information about the legal status of a particular land, with all legal consequences that might have occurred on it. Secondly, through organisations, the information structures along with data models should adapt to the needs of society, which change over time. Thirdly, cadastral systems should operate in a direct and effective manner, using the latest technologies. Fourthly, the costs of the reforms should be borne by society as little as possible. As shown in Fig. 1, Poland in 2002 was at the stage of early implementation of market economy principles, which resulted, in the cadastre (the Land and Buildings Registry in accordance with the principles of the 2001 Resolution), in subsequent attempts being made to modernise the system. These concerned the possibility for transforming the system into a multi-purpose cadastre through further computerisation of data sets by means of analogue map vectorisation. Unfortunately, due to the measures taken and the financial savings, the cadastral data quality deteriorated, as indicated by the analyses provided in studies by (Hanus et al., 2021; Mika, 2018). It follows from these studies that in Poland, as of today,



**Fig. 1.** Stages of cadastre modernisation and the plan of transformation of the multi-purpose (2D) cadastre into the multi-dimensional (3D) cadastre in Poland  
 Source: own elaboration based on Mika (2018).

it is not possible to construct a multi-dimensional cadastre due to the poor quality of cadastral data.

The CADASTRE 2014 is characterised by 6 vision statements provided in Table 1.

The possibilities for the introduction of these 6 vision statements of “CADASTRE 2014” in Poland were already examined by Wilkowski (2010) and presented in “Space, Heritage & Future” for the GIS – Forum. The author indicated significant differences in defining the terms of “land parcel” and “land

property”. The implementation of the CADASTRE 2014 vision statements in Poland would ensure the consistent operation of two registers collecting cadastral data i.e. the Land and Buildings Registry and the Land and Mortgage Register. Unfortunately, the legal complications arising, *inter alia*, from historical factors have been preventing the merger of these institutions to this day. Their actual separate functioning is regulated by the applicable legislation. The rules applicable to the cadastre (Land and

**Table 1.** The vision statements of the CADASTRE 2014, in the context of changes introduced in Poland by the year 2022

Item	Principle	Commentary	Status as of 2020	Status as of 2022
1	“The CADASTRE 2014 will show the complete legal situation of land, including public rights and limitations!”	This means that the programme under design was intended to provide legal security for governmental institutions, non-governmental institutions, and for natural persons i.e. property owners. In this way, it would be possible to obtain complete documentation on the legal status of all land, including the objects located on it.	NOT IMPLEMENTED	NOT IMPLEMENTED
2	“The division into maps and registers will be abolished!”	Due to the development of information technologies, it will be possible to combine the graphical and descriptive parts of the cadastre by linking land objects directly to the information on them.	PARTIALLY IMPLEMENTED	IMPLEMENTED
3	“Cadastral maps will cease to exist! Long live modelling!”	Thanks to the digital data, IT systems are able to create models of objects, both based on their actual state of affairs and in accordance with the legal situation. This will result in the information storage function being lost by analogue maps which will only serve as a transparent and comprehensive data presentation.	PARTIALLY IMPLEMENTED	IMPLEMENTED
4	“The cadastre on paper will disappear!”	The author claimed that each concept of the cadastre in the world employed information technologies in the implementation of its assumptions. Initially, he believed that only developed countries would be able to follow this particular path. It turned out, however, that developing countries (like Poland) are also striving for modernisation, and do not limit their attempts to traditional methods.	PARTIALLY IMPLEMENTED	PARTIALLY IMPLEMENTED
5	“The CADASTRE 2014 will be highly privatised. The public and private sector will cooperate closely!”	As privatisation affects virtually every area of human activities, it will be no different with cadastral systems. However, the public domain’s task will be to care for land ownership titles. Its main task will be to supervise the entire project, and the operational work issues will be carried out by external organisations.	IMPLEMENTED	IMPLEMENTED
6	“The cost of CADASTRE 2014 will be recoverable!”	The development of the cadastre is a long-term investment, which affects the fact that the amortisation period for the costs laid out at the very beginning will be longer as compared with other goods.	NOT IMPLEMENTED	PARTIALLY IMPLEMENTED

Buildings Registry) are set out in the Land Surveying and Cartographic Law Act and in Regulation on the Land and Buildings Registry of 2001, while those applicable to the Land and Mortgage Register are set out in the Act on land and mortgage registers. The cadastre is maintained by Starosts in Poviats Land Surveying and Cartographic Resources, while the Land and Mortgage Register are maintained by District Courts competent for the place of jurisdiction of a particular property. The data and materials stored in the cadastre are processed by land surveyors. Land and Mortgage Register are created by lawyers. However, it is worth mentioning that until the end of 2022, Land and Mortgage Register have not been established for all properties in Poland. Many properties still have an unregulated legal status. It should be mentioned here that a significant relationship exists between the Land and Buildings Registry and the Land and Mortgage Register. The data on parcels e.g. the location, area, boundaries, and the soil class are the source of information included in Section I-O of the Land and Mortgage Register. The data on the owner of a particular property are imported to the cadastre from Section II of the Land and Mortgage Register. The opinion expressed by Wilkowski in 2010 is, unfortunately, still valid, and in 2020 we can say that the organisation of both registers is not conducive to the rapid implementation of the principles of the second statement of “CADASTRE 2014”. It is assumed that in the future, integration between the cadastre and the Land and Mortgage Register will be introduced in order to establish a new system containing information about properties, originating from multiple registers (Integrated Property Information System). As part of the implementation of the third and fourth statement, Wilkowski was of the opinion that in Poland, that state of affairs functioned practically in full. The only inaccuracies result from the diversity of programme tools used for studies in Polish cadastre. They do not ensure full compatibility; therefore, further modernisation work involves eliminating this problem. The number of programme tools is to be reduced, and their specificity unified. Unfortunately, this forecast did not come true,

and although in theory, in Poland, the uniformity of land surveying data is obligatory, in practice it is implemented in a diverse tool environment, which repeatedly hinders the land surveyor’s work. The fifth statement i.e. that of cooperation between the public and private sector, can also be, according to Wilkowski, considered to have been implemented. The operation pattern is characterised by the supervision on the part of the Land Surveying Service, the works being performed by the private sector i.e. land surveyors being responsible for submitting studies accepted for the resource. The supervision and control are exercised by Starosts who are the “head” of the Poviats Land Surveying Service. In addition, the issues concerning fees and their amounts are governed by regulations. Downloading data and materials from the resources is chargeable. This is the implementation of the sixth statement.

With the completion of the development of the CADASTRE 2014 vision, work began on another modernised vision of the register. Wilkowski and Karabin (2006) analysed the vision statements of CADASTRE 2020 as the future of the cadastral system in Poland. It was prepared for the 23rd Congress of the International Federation of Surveyors, which was held in Munich in October 2006. Research into the state of cadastral systems in certain European countries contributed to a comparative analysis in relation to the situation in Poland. European countries such as Austria, the Netherlands, Germany, and Sweden were taken for comparison. As reported by Wilkowski and Karabin (2006), in the implementation of the transitional model of the CADASTRE 2020, apart from the organisational pattern originating from certain European countries, an important role was played by the previously implemented projects. First of all, these were projects Phare 2000 and Phare 2001, which were mainly involved in the introduction of the IPE system i.e. the Integrating Electronic Platform. The target concept of a cadastral system model i.e. the cadastre after 2020 was mostly based on the methods already employed in the EU Member States and in Norway. The proposed further changes generally concerned the reduction in the costs of maintaining

two separate systems in Poland i.e. the Land and Buildings Registry and the Land and Mortgage Register. It was estimated that more than half of the information on properties is duplicated in both these systems. The main idea of the target concept was to establish the Central Cadastral Database cooperating with the IPE platform.

In addition, the reform of the cadastral system in Poland involved the implementation of regulations and European standards (ISO 19152 LADM and the INSPIRE Directive of 2007). Figure 2 presents changes in regulations concerning the cadastre on the timeline between 1969 and 2022. It only shows the tendencies towards transforming the Land and Buildings Registry into the cadastre. The change in the register name has not been followed by parallel and effective transformations of the databases, without compromising the quality of cadastral data.

According to Article 2(8) of the Land Surveying and Cartographic Law Act of 17 May 1989 (consolidated text: Journal of Laws of 2019, item 725, as amended), the definition of a cadastre is as follows:

“(…) an information system that ensures the collection, updating, and sharing, in a manner uniform for the country, of information on land, buildings and premises, their owners, and on other entities holding or managing these land, buildings or premises (…)”. Article 21 of the same Act defines the functions of the data on land and buildings, which are collected in the register. They are crucial for spatial planning, setting tax rates, keeping public statistics, real estate trade, and registering agricultural farms. They also provide the basis for indicating properties in the second public register i.e. the Land and Mortgage Register. The authorities along with other units involved in organisational matters, in cooperation with the Land Surveying and Cartographic Service, perform these specific tasks in order to ensure efficient data exchange between registers. Unfortunately, in practice, many disadvantages of this cooperation can be seen, which was reported by *inter alia* (Hanus et al., 2014; Maślanka, 2018; Pęska, 2014; Przewięźlikowska, 2020), who focused mostly on the analysis of the cases located in Małopolskie Voivodeship.

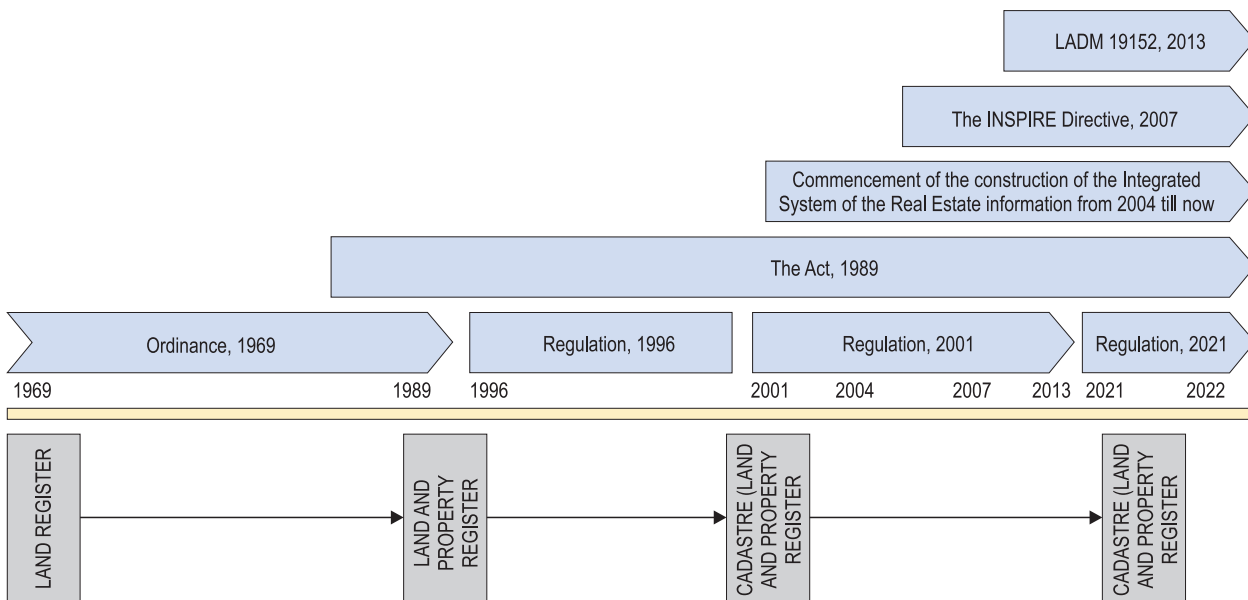


Fig. 2. Selected legal acts on the cadastre in Poland in the recent 50 years

Source: own elaboration based on Mika (2018).

## MATERIALS AND METHODS

The basic research material included the above-analysed source texts of international cadastre construction concepts for the CADASTRE 2014 and CADASTRE 2020. In order to achieve the intended goal, the descriptive and comparative analysis method was employed according to the adopted criteria. The area analyzed is located in two different geographical regions: the Lublin Upland and the Lublin Polesie, as well as two subregions: the Łęczyńsko-Włodawskie Lake District and the Dorohusk Depression, divided into 6 communes. Detailed research was conducted in two representative *poviats* (administrative units) of Lubelskie Voivodeship. The Łęczyński and Lubartowski Poviats are situated in the central part of the voivodeship. The total area of Łęczyński Poviats is 637 km<sup>2</sup>. It is divided into five communes (Cyców, Ludwin, Milejów, Puchaczów, and Spiczyn), and one urban-and-rural commune (Łęczna). Łęczyński Poviats is situated at the interface of two different geographical regions: the Lublin Upland and the Western Polesie, and its two sub-regions: the Łęczyńsko-Włodawskie Lakeland and the Dorohusk Depression. The entire area of the *poviats* is located within the North European Plain, which is the explanation for the plain land used mainly for agricultural purposes. Łęczyński

Poviats is characterised by a quite low forestation rate. Forested areas, wooded land and bushland occupy slightly above 15% of the area (including forests 13%). Łęczyński Poviats comprises 117 localities (including 116 villages), divided into 6 communes. In Łęczyński Poviats, individual owners own 76,593 parcels with an average area of 0.65 ha. This, however, varies from commune to commune.

Lubartowski Poviats occupies the area of 1290 km<sup>2</sup> and is divided into 13 communes, including 10 rural communes, 2 urban-and-rural communes, and 1 municipality. The *poviats* is located in the northern part of Lubelskie Voivodeship, and covers an area situated at the interface of three geographical regions: Mazovia, the Lublin Upland, and the Western Polesie. A significant part of the *poviats* is occupied by an undulating moraine plain, Lubartów Upland, a Mazovia mesoregion, and the remaining part by the Łęczyńsko-Włodawskie Lakeland being part of the Western Polesie. The Lubartów Land is a vast plain through which the Wieprz River flows. In Lubartowski Poviats, soils of poor valuation class are found. No soils of class 1 are found there, and the overall area of soils of class 2 is only 13 ha. On the other hand, the class 4 soils and poorer account for 88.5% of the overall area of agricultural land. In Lubartowski Poviats, the area of forested land is 26,233 ha, which accounts for



Fig. 3. Spatial location of the research object



20.3% of the *poviat*'s area. The *poviat* under analysis is divided into 243,824 parcels with an average area of 0.53 ha.

The spatial location of the area under analysis in relation to Europe, Poland, and Lubelskie Voivodeship is shown in Fig. 3.

The research materials included survey statements drawn up based on the data derived from the cadastre.

The study was conducted on 20 randomly selected cadastral districts in two *poviats* of Lubelskie Voivodeship. 442 survey statements were analysed, which accounts for 42% of all statements drawn up in the analysed districts in the year 2020. The number of examined cadastral parcels is 1322 (Table 2).

The study revealed eleven error types (Table 3), the frequency of which was analysed in detail.

**Table 2.** Summary of the data covered by the study

Poviat	District	Area [ha]	Number of survey statements in the district	
		Number of parcels	Number of survey statements examined	Number of parcels in the district
1	2	3	4	5
Łęczyski	Rogóżno	790.1940	100	2543
		2543	48	78
	Nadrybie Wieś	572.1273	43	705
		705	12	31
	Jaszców	669.9708	54	1412
		1412	22	56
	Cyganka	327.0209	15	429
		429	5	50
	Łysołaje	262.9965	222	1194
		1194	53	154
	Turowola	622.0408	55	885
		885	38	52
	Puchaczów	572.1919	47	1900
		1900	18	54
Ostrówek	361.4446	10	218	
	218	5	15	
Podyski	340.2286	23	415	
	415	8	20	
Nowy Radzic	1376.1878	38	2389	
	2389	15	68	
Lubartowski	Rozkopaczew	524.5478	69	875
		875	36	121
	Kolechowice	432.0124	20	421
		421	8	20
	Kamionka	635.2145	80	1245
		1245	34	50
	Dębiny	250.2145	30	351
		351	15	25
	Sosnówka	361.2543	38	460
		460	20	58
	Jeziorzany	270.3415	55	728
728		21	56	

cont. Table 2

1	2	3	4	5
	Klementynów	919.1028 2006	63 31	2006 123
	Tarło	282.1311 683	20 8	683 22
	Pałecznicza	279.3676 342	10 5	342 15
	Nowa Wola	572.1254 542	63 40	542 254
	Total	10420.7151 19743	1055 442	19743 1322

**Table 3.** Types of errors in the cadastre

Error designation	Description
T1	discrepancies between archival materials and the current Land and Buildings Registry
T2	errors arising from land consolidations
T3	discrepancies related to the actual existence of public roads in the field, and their absence on maps and in the Land and Buildings Registry
T4	problems related to river shoreline
T5	problem related to the roads constructed on natural persons' parcels
T6	discrepancy between the Land and Buildings Registry and the Land and Mortgage Register
T7	errors in the area of parcels and land in use
T8	errors in parcel numbering
T9	errors in property owners' personal data
T10	failure to disclose the title of property ownership
T11	discrepancy between land in use recorded in the Land and Buildings Registry and the actual field situation

### CADASTRE 2020 in practice – a case study

The study demonstrated that there was still no electronic database of the Land and Buildings Registry in certain areas, and that the currently functioning public registers e.g. the cadastre and Land and Mortgage Register were two-dimensional in nature. Moreover, they are affected by errors that have an adverse effect on the cadastral data quality.

One of the major problems that arises in today's cadastre is the discrepancy between archival materials and the current Land and Buildings Registry (T1). Figures 4 and 5 show an analogue principal map of 2009, which showed no cadastral boundaries of the parcel. At the Poviát Centre for Land Surveying and

Cartographic Documentation, there was no overlay on the map for the land register itself. After the plotting (digitisation) of boundaries on the principal map during the shift from analogue map to the digital version in 2015, it appeared that the existing buildings had been constructed not in line with designs, and parts of the buildings were located outside their parent parcels. It can be seen very well in parcel No 46/26 or 64, where half of the building is located on a parcel which is a road.

Figure 6 shows another case where a part of the building is located on a parcel not belonging to the building owner. This is parcel No 1665, district of Rozkopaczew, cadastral unit of Ostrów Lubelski, Lubartowski Poviát, Lubelskie Voivodeship. In 2007,

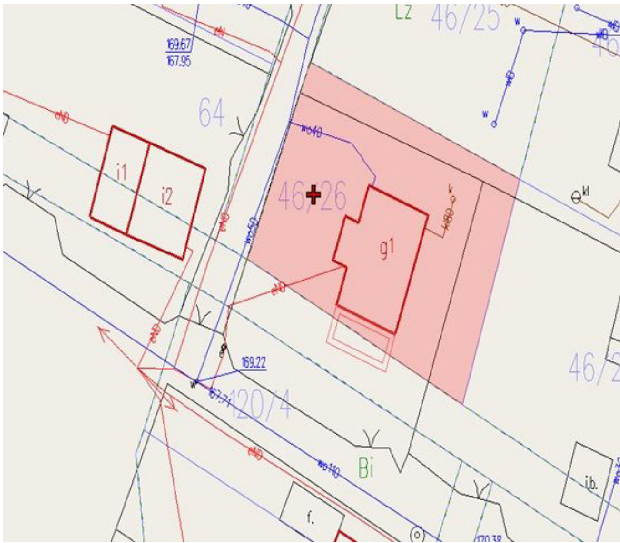


Fig. 4. A fragment of a principal map as of 09 September 2020. Parcel No 46/26, district of Rogóżno, cadastral unit of Ludwin, Łęczyński Powiat, Lubelskie Voivodeship



Fig. 6. Parcel No 1665 from the geoportals database

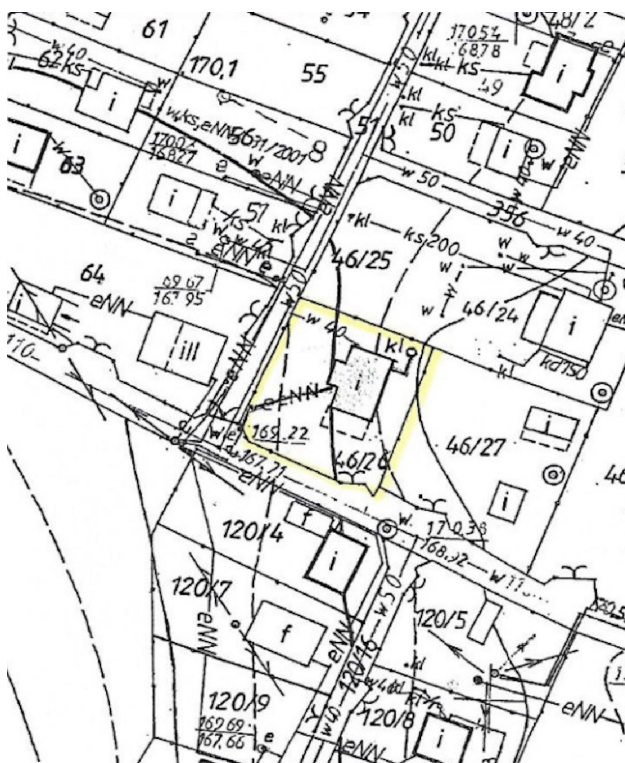


Fig. 5. A fragment of an analogue principal map as of 16 September 2009

in the village of Rozkopacze, land consolidation was conducted (T2). During the consolidation process, a farm building (barn) was located on parcel No 1665. The consolidation for this parcel was conducted based on division diagrams and measures shown on them, which were carried out in 1977. In theory, the consolidation should be laid out on the ground (the course of the boundary crossing the building would be noticeable then), but in this case, this obligation was most certainly not met. The error which emerged in 1977 was repeated during the consolidation in 2007. A part of the building from parcel No 1665 is located on the neighbouring parcel. This error could be rectified in the course of the consolidation procedure. Unfortunately, the parcel owner's failure to take care of the case, and the inaccurate conduct of the consolidation procedure resulted in the situation where the case presented above can only be resolved in court proceedings.

Another emerging problem is the roads which are found in the field but are not recorded in the Land and Buildings Registry (T3). This problem is shown in Fig. 7 (parcel No 215/5, district of Nadrybie Wieś, cadastral unit of Puchaczów, Łęczyński Powiat, Lubelskie Voivodeship). The fragment of the map,



Fig. 7. Parcel No 215/5, an aerial photograph – geoportál

shown in Fig. 8, contains parcel No 215/5, this is the current situation as of 09 September 2020, “containing” a road which, at the time of the consolidation conducted in 1977 (Fig. 9), was a separate cadastral parcel. Over time, the parcel was absorbed by parcel No 215/5 (Fig. 8). Unfortunately, despite the attempts to find the reasons for this, the authors failed to explain this matter. Physically, in the field, the road still exists, while in the Land and Buildings Registry, such a parcel does not exist.

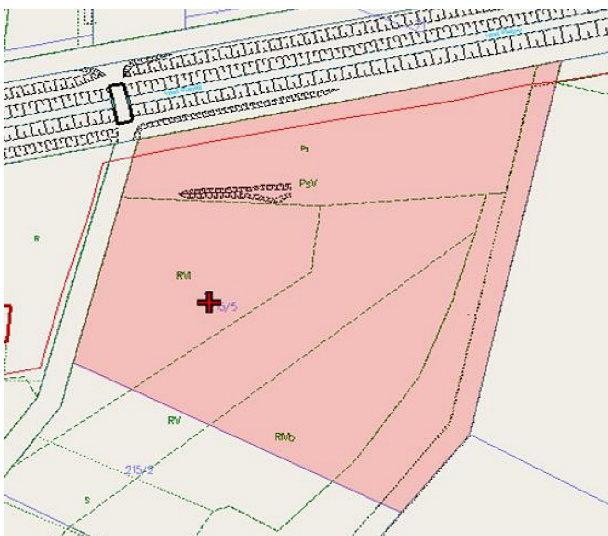


Fig. 8. A fragment of a principal map as of 09 September 2020

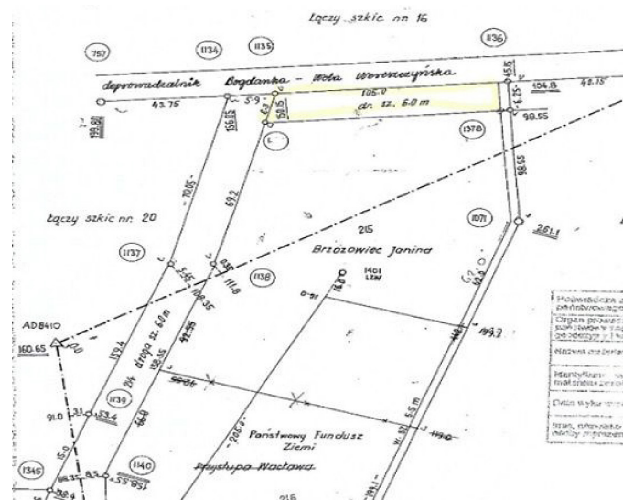


Fig. 9. A fragment of consolidation diagram of 1977, which shows a parcel that is a road with a width of 6.00 m

Another problem is related to the course of the river’s shoreline. It is shown in Fig. 10 (parcel No 172/3, district of Jaszczów, commune of Milejów, Łęczyński Powiat). The shoreline of natural watercourses is the property boundary, and the constant changes in the course of the river bed, resulting from natural factors, not only change the boundary of the cadastral parcel but, primarily, change the scope of the property right (T4). The basis for describing the shoreline course is the data demonstrate in the Land and Buildings



Fig. 10. Parcel No 172/3, an aerial photograph – geoportál

Registry documentation. The level of quality of the data contained in the Land and Buildings Registry has a significant effect on the quality of the data determining the shoreline course. This problem is well noticeable in Fig. 11 which shows a fragment of a principal map with visible parcel boundaries. However, the actual situation is presented in Fig. 10 where, based on an aerial photograph, one can see the shift of the natural river bed, and the “entering” of the river into the parcels neighbouring with the shoreline.

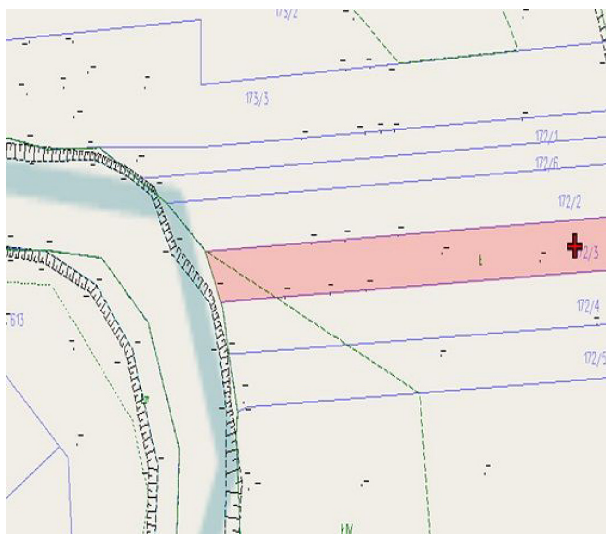


Fig. 11. A fragment of a principal map as of 09 September 2020

In view of multiple problems emerging in the cadastre, attempts are being made to rectify the errors of the past. Figures 12 and 13 show the parcel 290/4 which initially had the number of 290/2. The parcel No 290/2 in question was divided into 3 parcels i.e. 290/3, 290/4, and 290/5 in order to separate from it the part occupied by a public road constructed in the 1970's (T5). The division was conducted based on the provisions of the Act on real estate management and of the Act on detailed rules for the preparation and implementation of investments in public roads.

The proceedings conducted in this way enable the regulation of the state of ownership. Pursuant to Article 73 of the Act of 13 October 1998, the provisions introducing the acts that reform the public administration, the properties remaining, on 31 December 1998, under control of the State



Fig. 12. Parcel No 290/4, an aerial photograph – geoportal

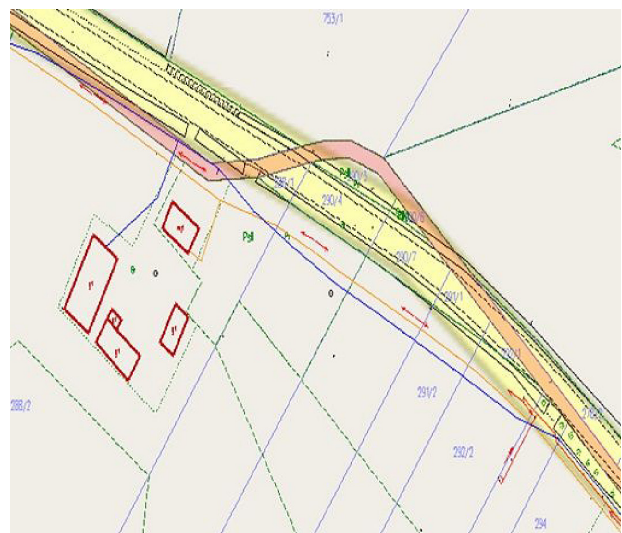


Fig. 13. A fragment of a principal map as of 09 September 2020

Treasury or local government units, not owned by them and occupied for the construction of public roads, on 1 January 1999 they become, by virtue of law, to be owned by the State Treasury or relevant local government units for a compensation. This provision enables the separation, from a parcel being under control of a natural person, of a parcel occupied for the construction of a public road, and the payment of compensation.

The remaining error types i.e. T6-T11 concern the descriptive part of cadastral survey.

## RESULTS AND DISCUSSION

The cadastre is the crucial database for numerous land surveying and legal operations. By definition, it forms the core of tax assessment and spatial planning and contains a lot of relevant land surveying and legal information. Both in Poland and worldwide, work is still underway to improve the data quality and to ensure the safety of using cadastral data. As demonstrated in the case study, in Poland there are still a number of inaccuracies or discrepancies in the data collected in the Land and Buildings Registry. Many areas in the country have no source materials concerning parcels besides the documentation drawn up in the 1960's and 1970's as part of the establishment of the register (Bydłosz, 2012; Dawidowicz & Żróbek, 2018; Karabin, 2012). Table 4 lists the types and number of errors detected in relation to the study area.

The study results showed that each of the districts under study was affected by different error types. 996 errors were recorded for the 1322 parcels examined (Fig. 14). Most errors were noted in the district of Łysołaje in Łęczyński Powiat (154). The fewest errors were found in the district of Pałecznicza in Lubartowski Powiat (7).

On the other hand, Fig. 15 shows the distribution of individual error types identified in the area under study.

The most common type of error is the discrepancy between the land in use recorded in the Land and Buildings Registry and the actual field situation (T11). The second error in terms of its frequency in the area under study is an error in the area of parcels and land in use (T7). The reason for the occurrence of such a high number of these two error types is the lack of data updates in the Land and Buildings Registry.

**Table 4.** Distribution of errors in the area under study

Powiat	District	Type and number of errors detected											Total
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	
Łęczyński	Rogózno	42		9			8	6		5	1	7	78
	Nadrybie Wieś	4		11			4	8	2	2			31
	Jaszczów	2			15	5							22
	Cyganka					43	3	4	4	1	4		59
	Łysołaje	6		3	54	15	10	25	4	2	4	31	154
	Turowola		15				4	25		1	5	1	51
	Puchaczów	3		2			17	24		15	3		64
	Ostrówek Podyski		4	1						4			9
	Nowy Radzic	4	5				5	12					26
Jawidz			2			20	15	21	3	8	42	111	
Lubartowski	Rozkopaczew		20	1			15	8			15	17	76
	Kolechowice	10					12	5	2	4	1		34
	Kamionka	5		2		1	5	10	4	1	12		40
	Dębiny		5									15	20
	Sosnowka	11		2		5	8						26
	Jeziorzany	2	4		20					2			28
	Klementynów	1	2						3			51	57
	Tarło	10					4				4		18
	Pałecznicza	2				5							7
	Nowa Wola	23		3			20			4	5	30	85
Total	125	55	36	89	74	135	142	44	40	62	194	996	

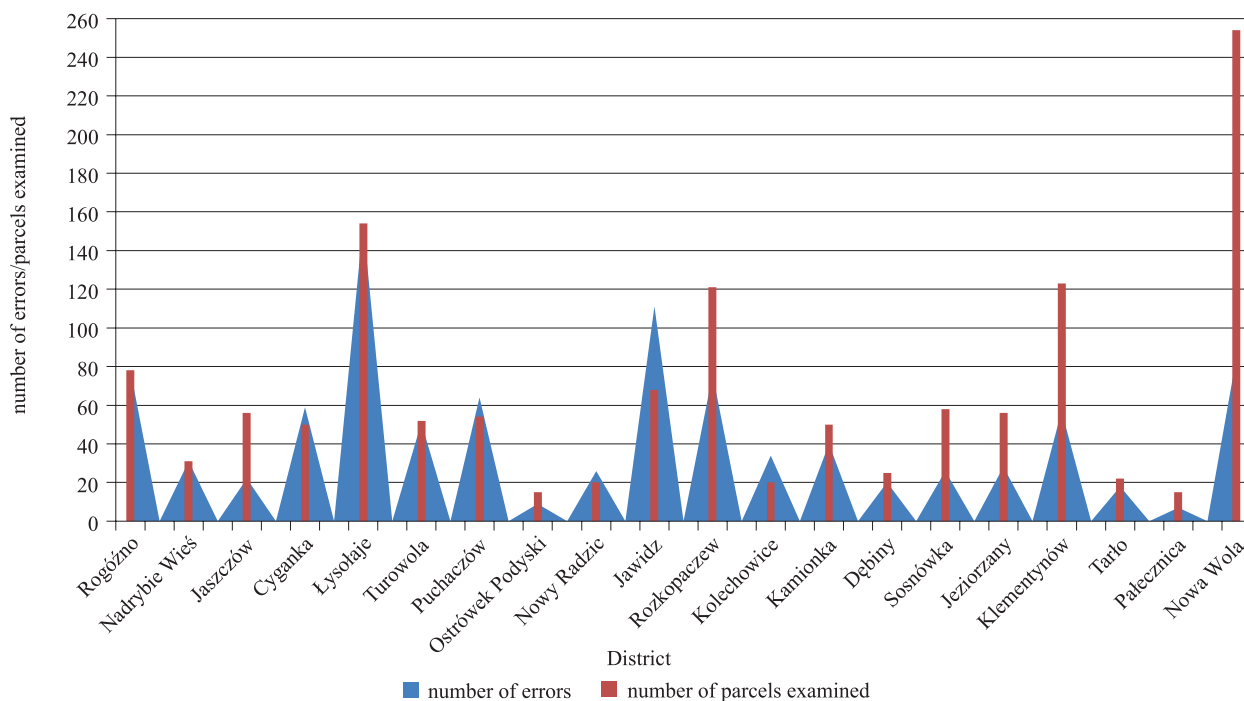


Fig. 14. Distribution of the number of errors in relation to the number of parcels examined

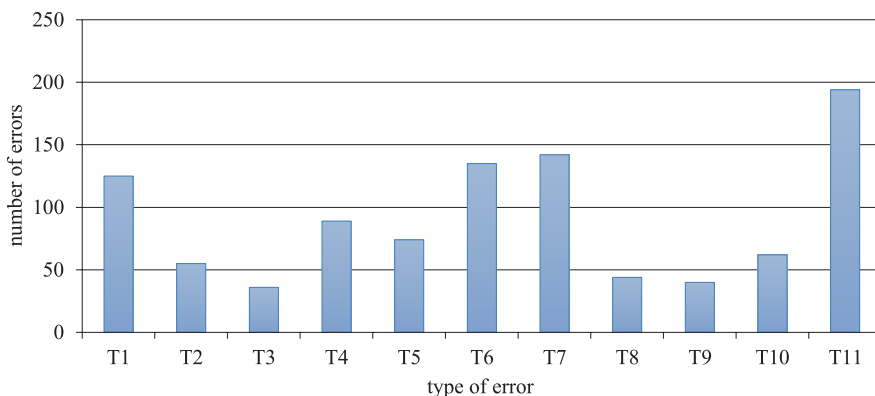
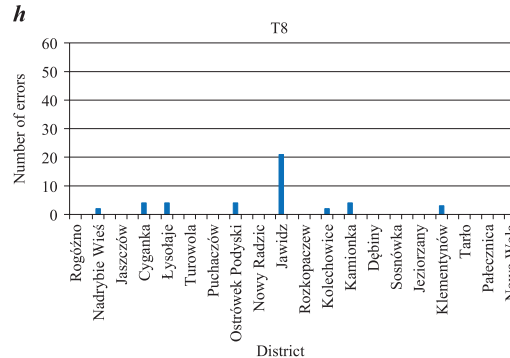
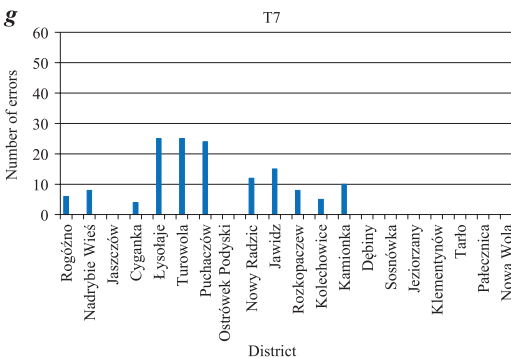
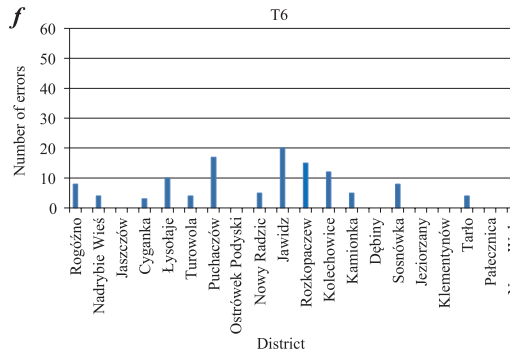
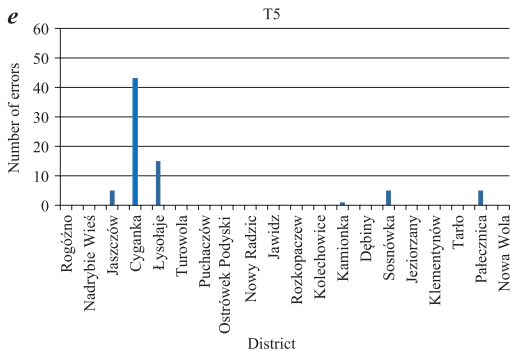
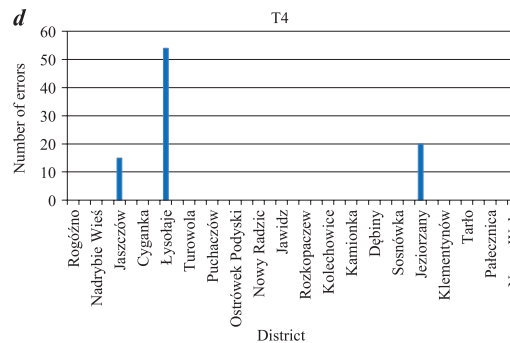
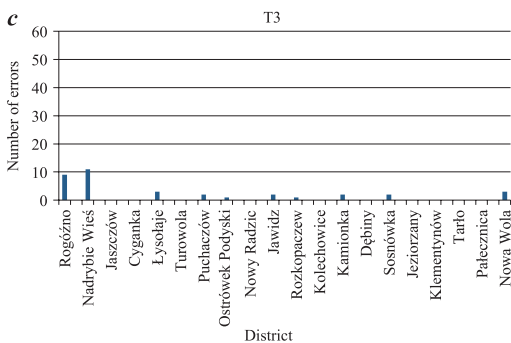
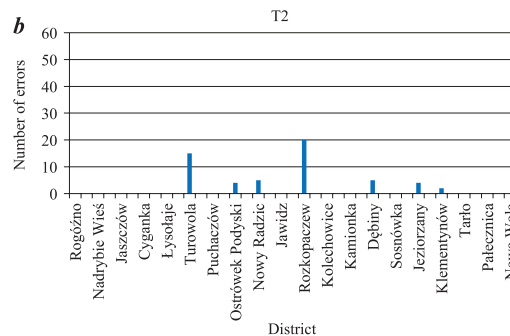
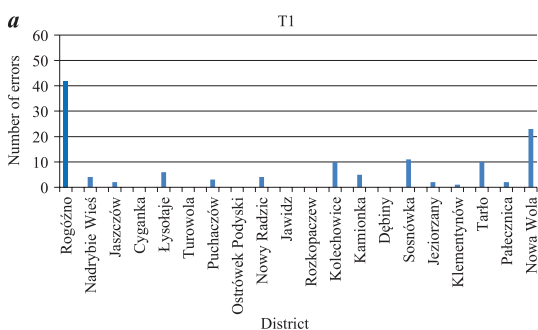


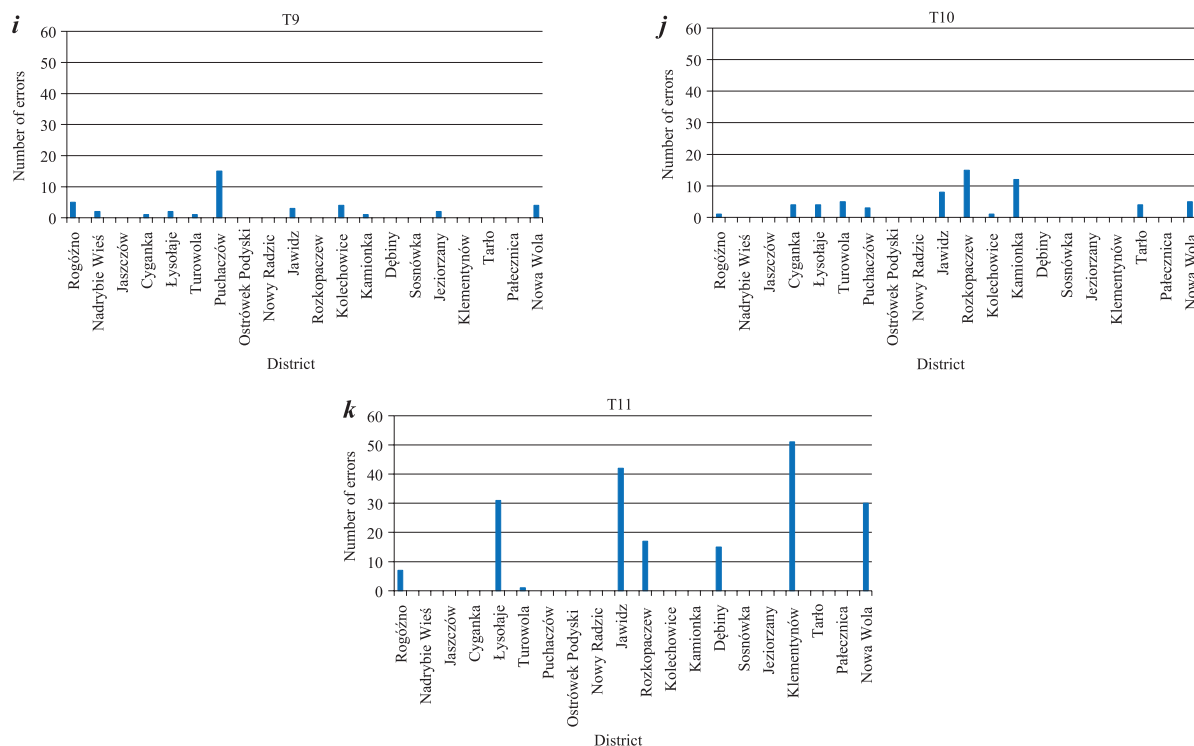
Fig. 15. Number of errors recorded for individual error types

The large scale of the errors detected concerns the discrepancy between the Land and Buildings Registry and the Land and Mortgage Register system (T6). From the perspective of cadastre construction and the reliability of data collected in it, this error should be eliminated in the first place. The consistency of data between these databases guarantees the construction of a reliable cadastral system. Discrepancies between archival materials (cadastral maps) and the Land and Buildings Registry map (T1) were detected in 125

survey statements examined. Problems related to a river shoreline (T4) were demonstrated in 89 survey statements. A problem related to the roads constructed on natural persons' parcels (T5) was demonstrated in 74 survey statements. Moreover, 62 cases of failure to enter titles of property ownership into the register (T10) were noted, which is due to the faulty information flow between the Land and Mortgage Register system and the Land and Buildings Registry. The T2 error type was identified in 55 survey statements. It concerned







**Fig. 16.** Distribution of the number of individual error types in the area under study; a) – discrepancies between archival materials and the current Land and Buildings Registry (T1); b) – errors arising from land consolidations (T2); c) – discrepancies related to the actual existence of public roads in the field and their absence on maps and in the Land and Buildings Registry (T3); d) – problems related to river shoreline (T4); e) – problem related to the roads constructed on natural persons' parcels (T5); f) – discrepancy between the Land and Buildings Registry and the Land and Mortgage Register (T6); g) – errors in the area of parcels and land in use (T7); h) – errors in parcel numbering (T8); i) – errors in property owners' personal data (T9); j) – failure to disclose the title of property ownership (T10), k) – discrepancy between land in use recorded in the Land and Buildings Registry and the actual field situation (T11)

the errors arising from improperly conducted land consolidation procedure. The conducted case study demonstrated the commonly occurring problem of erroneous parcel numbering (T8), primarily due to human errors. Errors concerning property owners' personal data (T9) were demonstrated in 40 cases. The detection of this error type once again proves the inconsistency between the data contained in the Land and Buildings Registry and those in the Land and Mortgage Register. The fewest detected cases concern the discrepancies related to the actual existence of public roads in the field, and their absence on maps and in the Land and Buildings Registry (T3). These cases are a consequence of systemic transformations which took place after the Second World War.

Figure 16 presents the distribution of the number of errors in individual districts in the area under study. The occurrence of the T1 error that indicates a discrepancy between archival materials and the current Land and Buildings Registry was noted in 14 out of 20 districts under study. An analogous situation concerns the errors involving the inconsistency between the factual circumstances (Land and Buildings Registry) and the legal status (Land and Mortgage Register), namely the T6 errors. Therefore, the study results prove that in only 30% of the districts, there is a full data compliance between the land register and the actual field status. A lower degree of error occurrence was noted for error types T3, T7, T9, and T10 which occur in approx. 50% of the districts. Error types T2, T5, T8, and T11 are found in approx. 35% of cases. The error type found in the smallest number of the districts under study is T4 which concerns the discrepancy between the course of river shoreline and the cadastral parcel boundaries, and is attributable to the fact that in the area under study, the river flows through only three districts, namely Jaszczów, Łysołaje, and Jeziorzany. Nonetheless, the number of these particular errors is relatively high, and accounts for almost 10% of all errors.

## CONCLUSIONS

The modernisation of the Land and Buildings Registry towards a fully-fledged cadastre, whose principles will be based on international standards and norms, is being carried out in Poland in a slow and inefficient manner. It brings many problems to land surveying contractors through constant reforms of regulations, and in particular their implementation in practice. There is no doubt, however, that these reforms are needed, and that they are on good track. The fact that it is possible to construct a cadastral system in post-Communist countries is evidenced by the experiences of other countries, including Slovakia and the Czech Republic (Hudecova & Kysel, 2019; Muchová & Raškovič, 2020; Muchowa & Juskowa, 2017; Parsova et al., 2012; Pesl, 2003), which, during the Partitions or wars, also had similar experiences that stamped their influence on, *inter alia*, the Register data. The successor states of the Austro-Hungarian Monarchy and also Poland organize regular, joint cadastral conferences at the highest level of departmental authorities, where, among other things, they are discussed in detail about the state of their cadastral systems.

The aim of this article was to show the effects of modernisation of the cadastral system in Poland by implementing international standards and regulations. The conducted case study directly reveals the unsatisfactory status of cadastral data quality, which concerns both the descriptive part and the graphical part of the Land and Buildings Registry documentation.

The study demonstrated that, as regards the implementation of regulations, the status of Polish cadastre is satisfactory. Polish regulations are based on international standards. Unfortunately, their translation into the land surveying practice fails to bring tangible results of the cadastral system improvement.

In the years of cadastre development in Western Europe, there was a difficult period of systemic transformation aimed at restoring private property

in Poland and other post-Communist countries. The cadastral reforms involved changes in the system name and the scope of cadastral data. Unfortunately, the form of converting analogue maps to digital ones by means of scanning, vectorisation, and digitisation has contributed to the loss of quality, and sometimes even of cartometricity.

*How does the cadastre in Poland function, and what problems does it encounter in the year 2020?* 996 various error types were detected on 1322 parcels. This shows that 75% of the parcels under study are affected by errors, some of them even by a few error types. Almost every parcel is affected by an error. Most errors concern the discrepancy between the types of land in use recorded in the Land and Buildings Registry and the actual field situation (T11). This is due to the faulty procedure for updating cadastral data. Changes in land in use are not implemented on an ongoing basis. The distribution of errors shows no tendency for errors to be evenly distributed in *poviats* or in districts. This does not change the fact that in cadastral documentation randomly selected for the study, the cadastre functioning is defective. Continued use of data affected by errors will generate further errors.

Based on the study conducted, a general conclusion can be drawn that the identified number of eleven error types represents three major groups of CADASTRE 2020 problem in Poland. The first group includes errors arising from incorrect data processing in order to digitise the resource (T1, T2, and T3). The second group relates to the faulty information flow between the actual status register (Land and Buildings Registry) and the legal status (Land and Mortgage Register) (T6, T9, and T10). The third group includes human negligence errors or systemic errors arising from the lack of relevant regulations (T4, T5, T7, T8, and T11).

Based on the research conducted and the resulting conclusions, the authors of the article believe that they may constitute the first step in the scientific discussion on the condition of the cadastre in a global perspective.

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