

Foreign Practices in Land Cadaster Systems: An Experience for Ukraine

Daria Kondratenko¹, Olena Savchuk², Anna Liubchych³

Abstract

The experience of European organizations managing land cadaster system is analyzed with examples of land relations development given for different spheres: legal, technical, and economic. The peculiarities in adoption and application of the 3D land cadasters by different countries of the world is viewed. It is stated that a cadaster of the future is to be a multi-purpose one in the 3D or 4D format.

The need in modernizing current land legislation to improve the procedures of collecting, preserving, restoring, and utilizing land resources in Ukraine pertaining to implementation of the principle of the State land cadaster keeping is accentuated on.

Advantages of account-and-registration systems are analyzed; the legal nature of social relations arising in this sphere is clarified. Recommendations concerning establishing the 3D cadaster in Ukraine are offered.

Key words: lands account, cadaster systems, land, land parcels, the 3D cadaster.

1. Introduction

The issues of harmonization of land cadaster policies and the estimation of its relevance are presently of great importance, for Ukraine has chosen the integration into the European economic space as a strategic direction for itself.

One of the state's important issues is establishing the national cadaster system, which, relying on the European and the world experience, would combine the best and perspective technologies of building up such a system taking into account the mentality and priorities of the nation, the character of social relations, the territory, the administrative division, the current state of legal and material support of cadaster-related works. Formulating the main items and principles of building up the cadaster system of Ukraine is one of the key moments of not only an efficient management of cadaster objects, but also, to a certain extent, the national interests protection for the good of society as a whole. An important aspect of the problem of building up the cadaster

¹Postgraduate student of the Department of Land and Agrarian Law of Yaroslav Mudryi National Law University ORCID:<https://orcid.org/0000-0001-8197-8032>.

²PhD is scientific associate, Scientific and Research Institute of Providing Legal Framework for the Innovative Development National Academy of Law Sciences of Ukraine, ORCID: <https://orcid.org/0000-0003-3299-7936>.

³PhD is Scientific Secretary of Institute, scientific associate, Scientific and Research Institute of Providing Legal Framework for the Innovative Development National Academy of Law Sciences of Ukraine, ORCID:<https://orcid.org/0000-0002-6492-4179>.

system is the optimum choice of separate construction elements and their interconnections in accordance with the existing experience along with approving them and building up new ones¹.

2. Main material exposition.

The West-European cadaster systems are practically the same in their general outlay: the land parcels register, cadaster maps, and keeping legislative entries. On the other hand, the techniques of property accountancy differ, although every country has the register of realties. The Land register (the Land book) may serve either as such a register or as a part of it. The cadaster (or the sum total of cadaster surveys) and the Land register is usually kept by a single organizational service; in some cases these services are different, but cooperate with one another in data exchange for mutual control and forming of a multi-purpose cadaster.

The common feature of the West-European cadaster information systems is that they ensure systematic covering of the whole territory and constant information updating. For a land information system, this is the only guarantee of its efficiency. To the common features should also be referred the similarity in the techniques of entering information into the registers. As a rule, land parcels are characterized by the land-using type, the area, the types of buildings on them, their location, the information on the owner, and references to other registers and information systems that contain additional data on the territory and the owner².

The world cadaster systems in general usually operate according to either centralized or decentralized organizational model. To the administrative bodies in the sphere of geodesy, cartography, and cadaster pertain: cadaster services, topographic survey service, geodesy and cadaster inspectors, the institute of geodesic, topographic, and cartographic research, It is possible to demonstrate a decentralized organization model on the example of the cadaster system of Germany, whose territory is divided into 16 administrative units, or lands. Each land has its own cadaster service, which reports to a certain Ministry or service depending on the administration level (the federal or a local one). The world practices attest to the fact that the centralized model of cadaster systems organization has the greatest advantages. In order to raise its functioning efficiency it is necessary to form local working groups, which will take unbiased decisions at the local

¹ Gordiyenko L.O. (2019) *Suchasnyi stan kadastruvoyi systemy Ukrainy. Systemna vzyemodiya kadastriv: problemni pytannya metodologichnogo, instyutsijnogo ta informatsijnogo zabezpechennia*. Zbirnyk materialiv Mizhnarodnoyi naukovo-praktychnoyi konferentsii (Kyiv, 29-30 bereznya, 2019). [Current state of the cadaster system of Ukraine. Systemic interaction of cadasters: problematic issues of methodological, institutional, and information support. International science-practical conference materials (Kyiv, March 29–30, 2019)]. K., DP "Komprint", 56-58. [In Ukrainian].

² *Zemelnyi kadastr: V 6 t. T. 1. Upravlyeniye znyemelnymi resursami* [Land cadaster: in 6 vol. Vol.1. Land resources management]. M. : KolosS. Moscow, "ColosS" PH. 2003. 383. (p. 352) [In Russian]

level, and a simplified mechanism of gathering, processing, and transferring information through broadening functionalities of cadaster services' web portals³.

These data together with other information systems enable obtaining multi-layer information on owners and of the land parcels they own. An exception from this rule is the English system equivalent to a cadaster in the all-European sense. In England, the cadaster contains cartographic information only, mostly on plots' borders and realties on them. The English system pays lesser attention to centralizing the systematic data on realty owners. In the continental Europe, the notion of cadaster in present-day interpretation means keeping systematic classification and evaluation of land on behalf of the state by means of topographic survey of the owned land parcels and keeping the register of land parcels and of their owners. Therefore, there exists the notion of a cadaster as a specific system of territories' description supported by maps, which includes not only the description of the plots' borders and land-using of each plot of land, but also the information on the land and its owner.⁴

It is possible to distinguish the following main principles of a land cadaster in foreign countries: 1) a cadaster will be utterly useless if it is incomplete for the territory to be analyzed; 2) work should be conducted on a solid foundation of reliable data; 3) expenses should be compatible with the expected average profits from the cadaster keeping; 4) the entries should serve not one, but several purposes; 5) a cadaster unit should be a single land parcel safely protected by law; 6) land entries should be kept on the basis of specific plots of land (land units), rather than on individuals (persons, owners); 7) expenses on making entries should be determined by the government; 8) the expenses on keeping and updating entries should be taken into account from the very beginning; 9) the design of the land accounting system should be oriented at the future⁵.

There is no unified land cadaster keeping system in the EU countries. Each country is characterized by its own special peculiarities. As established on the results of the research, in none of the studied countries the services on state land cadaster management are administrative bodies of state-owned agricultural land management. The task of state-owned agricultural land management is fulfilled by specialized state agencies. The analysis of the EU countries' practices concerning land cadaster policies and the activities of state agencies performing its administrating attests to the fact that their primary functional destination is gathering, handling, storing, and providing access to cadaster, geodesic, and cartography information, particularly the information needed for tax calculation, information on the location and borders of a land parcel, ownership type, granting permissions for construction or changing land's functional designation, etc.⁶.

³ Stupen' M. G. (2016) Svitovi dosvid funkcionuvannya u konteksti ratsionalnogo zemlekorystuvannya [World functional experience in the context of rational land utilizing]. *Investitsii: praktyka ta dosvid*. Investments: Practice and Experience. 2016, 17, 22-26 [In Ukrainian].

⁴ *Zemelnyi kadastr: V 6 t. T. 1.* p. 353 [In Russian]

⁵ *Zemelnyi kadastr: V 6 t. T. 1.* p. 355 [In Russian].

⁶ Khodakivska O.V. (2019). *Zemelno-kadastrava polityka v krayinah Yevropeiskogo Soyuzu. Systemna vzayemodiyia kadastriv: problemni pytannia metodologichnogo, instytutynogo ta informatsynogo zabezpechennia. Zbirnyk materialiv Mizhnarodnoyi naukovo-praktychnoyi konferentsii (Kyiv, 29-30 bereznia, 2019)*. [Land-cadaster policies in

Considering its large territory, there is no consolidated land cadaster system in the USA, which would encompass the whole territory of the country. Each state has its own cadaster system, but the basic principles remain the same. They include the division of each state's territory into cadaster blocks and sections. A peculiarity of cadaster keeping in the USA is Enactment system of rights registration. The state, acting solely as a registrar, does not bear any responsibility for the control of observing the law in conducting land transactions. The chief peculiarity of the land cadaster system in Germany is the absence of the federal level in it. Each land has its main office and regional representatives. Operations on registering land transactions are delegated to special officials who are licensed persons⁷.

In Canada, the office responsible for cadaster keeping, the lands inventory service, ensures land surveying by the same standards applied to the whole country in order to provide complete and up to date information concerning land productivity to federal and province power bodies. On the basis of the data obtained, the optimum system of planning and managing land resources, of land transformation prognostication is formed. In Italy, the land cadaster is subdivided into "the horizontal" one, to which pertain the objects located on plains, and "the vertical", or so-called urbanistic cadaster dealing with such objects as buildings, as well as industrial and commercial use objects. In Spain, the cadaster is of fiscal character. A cadaster system of this type usually consists of the cartographic and textual (graphic) sections. The cadaster includes the register of rights and cadaster maps. As a rule, the registers are compatible, but not integrated. Additionally, cadasters include the registers containing information on nature and climate conditions⁸.

Based of the analysis of the international experience and the perspectives of science and technical progress influence, it is possible to assert that a cadaster of the future should be a multi-purpose one in the 3D or 4D format. The 3D format will ensure that such important objects as tunnels, underground parking spaces, suspended ropeways, etc. are depicted in the cadaster charts, plans, and maps. Of importance is the 4D format, which will enable in real time mode to maintain control over the quality of the accomplished field cadaster works, ensure elimination of duplicating them, and make imprecise determining of border marks impossible.

An important role in social life will be played by cadaster systems that will be accessible for public on-line. These systems will integrate databases of other information registers, in particular ownership rights registers, realty price assessment, and so on. Land resources administrating in real life conditions should be based on the strategic decision

the EU countries. Systemic interaction of cadasters: problematic issues of methodological, institutional, and information support. International science-practical conference materials (Kyiv, March 29–30, 2019)]. K., *DP "Komprint"*, 2019. 31-37 (p.36). [In Ukrainian].

⁷ Taratula R.B. (2016). *Zarubizhnyi dosvid rozvytku zemelno-kadastryv system* [Foreign experience in land-cadaster systems development]. *Agrosvit*, 7. 17-21. (p. 18) [In Ukrainian].

⁸ Taratula R.B. (2016). (p. 18 [In Ukrainian].

making theory on conditions of total or partial uncertainty. Strategic economy decision making should be based on strategies assessment matrices taking into account officials' strategic actions. In doing so, the advantages of one strategy compared to another one should be determined on the basis of the risks matrix, and the choice of the decision strategy should be made depending on certain criteria⁹.

From the functional point of view, the cadaster of the future will need spatial 3D representation, as territories' urbanization, mountain recreation zones development, etc. require determination of the location and the dimensions of underground objects (tunnels, road junctions, parking spaces, infrastructure objects, etc.), and of various constructed objects like mountain skiing tracks, hiking routes, and so on. The cadaster of the future puts on the agenda the problem of the immediate transfer of the field measurement results to the cadaster database on-line that will enable automating the process of cadaster field information processing. This will cease cadaster works duplication and solve a number of disputable questions concerning geo-spatial location of cadaster objects. Such a cadaster is of the 4D type¹⁰.

In connection with an active intensification of land resources utilizing and extremely heavy conglomerating of realty and infrastructure objects on plots of land and under their surface, particularly within large cities, the introduction of the 3D cadaster in Ukraine is seen as a topical issue.

Starting on January 1, 2007, Ukraine, according to the Cabinet of Ministers of Ukraine Decree of 22.09.2004 No 1259 "Some issues of applying geodesic coordinates system", Ukraine transfers to the State geodesic reference coordinates system USK-2000, which has been modelled on the basis of GPS surveys. The USK-2000 coordinates system is established on condition of its axes being parallel to the spatial axes of the International Terrestrial Reference Coordinates System ITRS. The reference surface in the USK-2000 coordinates system is Krasovsky's reference-ellipsoid. The USK-2000 coordinates system has been approved by the International Terrestrial Coordinates System ITRS for the epoch 2000, ITRF2000, which is affixed by the cosmic geodesic network reference points. The USK-2000 is approved for performing topographic, geodesic, and cartography works on the territory of Ukraine¹¹. This is to say, that the Land Cadaster in Ukraine is created on the basis of the data of two-dimensional maps and topographic drawings that reflect land parcels in situ, but due to the application of the GPS surveys

⁹ Perovych I.L. (2019). *Napryamky rozvytku kadastrvoyi systemy Ukrainy. Systemna vzayemodiya kadastriv: problemni pytannta metodolohichnogo, instytutynogo ta informatsynogo zabezpechennia. Zbirnyk materialiv Mizhnarodnoyi naukovo-praktychnoyi konferentsii (Kyiv, 29-30 bereznia, 2019)*. [Land-cadaster policies in the EU countries. Systemic interaction of cadasters: problematic issues of methodological, institutional, and information support. International science-practical conference materials (Kyiv, March 29–30, 2019)]. K., DP "Komprint", 2019. 24-27 (p.25). [In Ukrainian].

¹⁰ Perovych I.L. (2019). p.27. [In Ukrainian].

¹¹ *Zakon Ukrainy "Pro derzhavnyi kadastr"* [Law of Ukraine "On State Cadaster"]: *naukovo-praktychnyi komentar (za stanom na 24 veresnia 2012 roku)*: science-practical commentary as of September 24, 2012. Kyiv, 2012, 98 (p.19) [In Ukrainian].

and satellite signals there is a possibility of designing “volumetric” maps and registration systems for land parcels and relevant objects in 3D.

Overall, there are not many clearly formulated definitions of a 3D cadaster. The most precise definition is probably the point of view by A.S. Popov: “under a 3D cadaster one should understand a cadaster that registers and gives the understanding on the rights and limitations of not only the land parcel, but also of the 3D property units. A 3D property unit (3D property) is a part of space needed for utilizing of the land parcel or a realty object and to which the property right applies in accordance with legislation¹².

It is expedient to offer a more compressed and specifying definition, according to which a 3D land cadaster is a system of account and registration of the main characteristics of land parcels and the realty objects and communications pertaining to them, as well as rights to them with the application of three spatial dimensions (length, width, and height).

The main preconditions for establishing a three-dimension model of cadaster registration are: 1) considerable raise in interest in land parcels and /or realty objects (especially those of private property ownership), and, consequently, raise in their price in cities; 2) the presence of a large number of land-property operations that take place on city plots of land; 3) a large number of tunnels (subway lines), cables (telecommunication, electric, telephone, etc.) and pipelines (water supply and sewage systems, etc.), construction of underground cities, parking lots, shops, and other multi-lever infrastructure; 4) development of 3D models in other spheres (three-dimensional geo-information systems, three-dimensional planning in construction) that makes it possible from the technology point of view to create a three-dimensional cadaster registration system¹³.

There exists the LADM international standard, which establishes a standard model of land administration and includes the basic information pertaining to the components of land administration (including water bodies and all elements above and below land surface)¹⁴. LADM explains the 2D and 3D images of spatial units. It also targeted at supporting cadaster account of 3D spatial units connected with specific rights and parties. It is of special importance for city areas that need taking measures on their infrastructure and information traffic to be structurally renewed from the 2D to the 3D presentation. The 3D cadaster account has already been tested and is practiced in an ever increasing number of countries. It is applied both for buildings (above/below/on land

¹² Popov A.S. (2009). *Peredumovy stvorennia 3D kadastru v Ukraini* [Preconditions of forming the 3D cadaster in Ukraine] (web-resource). *Agrarnyi visnyk Prychornomorja (Silskogospodarski, tebnichni, ekonomichni nauky)*. Agrarian Bulletin of the Black Sea Region (Agricultural, technical, and economy sciences), 2009, 51. Access mode: http://base.dnsgb.com.ua/files/journal/Agrarnyi-visnyk-Prychornomorja/Sg_T_E_n/2009-v51/Statti/2009-v51Statti-Popov.pdf. [In Ukrainian].

¹³ Popov A.S. (2009). [In Ukrainian].

¹⁴ Shypulin V.D. (2015). *Yevropejski standarty zemelnogo administruvannia dlia stvorennia seredovyscha stalogo rozvytku v Ukraini* [European standards in land administration for creating sustainable development environment in Ukraine]. Dept. of GIS, land and realties assessment, Kharkiv O.M. Beketov National University of City Planning, 2015, 81-93. (p. 87) [In Ukrainian].

surface, or constructions like tunnels and bridges), and (municipal) networks¹⁵. It is thought that Ukraine has to take into account the principles of the LADM standard when introducing the 3D cadaster on its territory.

There currently exist some blocks on the road to introduction and development of 3D cadasters in Ukraine. One of the major problems, like in many other countries, is unprepared, imperfect, and outdated legislation. Thus, it is needed to review legally fixated definitions of servitudes and of other rights on somebody's belongings, as well as common property and rights on utilizing of land parcels and other realties in three-dimensional space¹⁶. In addition, current land legislation for the most part ignores the status of "subterranean users" and relations concerning the use of "overhead spaces". This "conflict" in the part of distribution of rights and duties pertaining to land plots utilizing can be partially solved in terms of land-servitude relations, in particular through establishing a personal servitude, because current legislation does not give sufficient grounds to consider "a subterranean" and "an overhead" plots as two independent and separate plots¹⁷.

Presently, the main priorities in this sphere should be the settling of such issues as how exactly should be determined the purpose use of a land parcel whose subterranean and overhead spaces are used for needs that pertain to different categories of land, how to determine the ownership right on land and the objects that are on it, and, finally, how all this should be reflected in cadaster systems. Solving such issues becomes possible with the introduction of the 3D cadaster account, which due to spatial representation clearly displays land parcels' characteristics and the legal status of every realty object connected with them.

For integrating the 3D cadaster account in Ukraine, it is necessary to prepare recommendations on legal (a 3D-plot of land, 3D-property, a 3D-registration, a 3D-realty object, etc.) and organizational aspects of its forming¹⁸.

It will be possible to observe the benefits from the three-dimensional accountancy system not only regarding the utilizing of land parcels in urbanized localities, but also regarding all categories of lands. The possible chief advantages of a 3D cadaster can be

¹⁵ Shypulin V.D. (2015). p. 89 [In Ukrainian].

¹⁶ Ripenko A. (2010). *Perspektyvy zaprovadzhennia tryvimirnogo zemelnogo kadastru v Ukraini: skladnoschi mizhgaluzhevo pravovogo reguluvannia* [Perspectives of introduction of the 3D land cadaster in Ukraine: difficulties in interdepartmental legal regulation]. (Web-resource). *Zemlenporyadnyi visnyk: naukovo-vyrobnychyy zhurnal. Land-surveying bulletin: a science-industrial journal*. Access mode:http://www.academia.edu/10437865/3-D_CADASTRE [In Ukrainian].

¹⁷ Ripenko A. (2010). *Pravovi aspekty vykorystannia zemelnyh dilyanok ta inshoyi neruhomosti u tryvimirnomu prostori* [Legal aspects of land parcels and other realties utilizing in three-dimensional space]. (Web-resource). *Zemlenporyadnyi visnyk: naukovo-vyrobnychyy zhurnal. Land-surveying bulletin: a science-industrial journal*. Access mode: http://www.academia.edu/9335024/Правові_проблеми_тривимірного_3d_кадастр_в_Україні [In Ukrainian].

¹⁸ Openko I.A., Yevsiukov T.O. (2014). *Udoskonalennia obliku zemel pid polezalyssnyimi lisovymy nasadzheniamy v kadastravo-reyestratsiyniyi systemi* [Accountancy improvement of field-protection lands in the cadaster-registration system]. *Zbalansovane pryrodokorystuvannia: naukovo-praktychyy zhurnal*. Balanced nature utilizing: a science-practical journal. 2014, 3. 106-112. (p. 110) [In Ukrainian].

seen on the example of lands under field-protection forest plantations. They are: visualization of the land cadaster information on the field protection forested lands (FPFL) as 3D objects; a possibility of accomplishing different tasks concerning agro-forest-melioration protection of agricultural lands organization; it may serve as a foundation for designing a model of FPFL's efficient influencing agricultural lands; storing and displaying additional information that characterizes the FPFL's melioration state; qualitative characteristics of plantations; the simplest, prompt, and economically efficient retrieving, processing, and management of spatial data on lands under FPFL. On 3D land utilizing models it is convenient to represent the meliorative state of FPFL (the number of rows, the structure, the protective height of the FPFL, etc., the topography of the site), which is of utter importance for managerial and organization decision-making concerning territory management, and so on¹⁹.

The most developed countries of the world already possess an experience of partial transition to 3D cadasters, which is why it is expedient to view the peculiarities of account-and-registration system of foreign countries' land resources in order to determine positive tendencies and outcomes that should be aspired for by Ukraine as well.

The issues of creating 3D cadasters are being paid ever more attention in the world practices and theoretic research by Western scientists. Such cadasters have been adopted to a larger or smaller extent in Sweden and Norway. Test projects operate in Israel and the Netherlands. The USA have got their own model of three-dimension account of realty objects and sections of space²⁰.

Both the common law systems (with a few exceptions) and the continental legal systems overall adhere to the rule "to whoever owns the land, shall belong the earth to its center and up to the heavens", which, nevertheless, is tailored to present-day conditions. Therefore, the issues of utilizing of overhead and subterranean spaces (in some countries with the exception of mineral resources extraction) lay mostly in the plain of interests of the land's surface owner (user). But, the core of the matter, in fact, is that the freedom of the owner to exploit extensively the whole "column" of the space "from the center of Earth up to the heaven" is limited in some cases for the good of society as a whole, or of separate persons²¹.

It is interesting, that in some states of the USA, where the territory zoning has become especially wide-spread, there are considered even the cases of selling of the so-called "air rights" or "development rights" in the case when, for instance, an owner of a low-rise building located in a high-rise zone, alienates their right for development of this "space

¹⁹ Openko I.A., Yevsiukov T.O. (2014). p. 110 [In Ukrainian].

²⁰ Ripenko A. (2010). Pravovi aspekty vykorystannia zemelnyh dilyanok ta inshoyi neruhomosti u tryvimirnomu prostori [Legal aspects of land parcels and other realties utilizing in three-dimensional space]. (Web-resource). *Zemleporiadnyi visnyk: naukovo-vyrobnychij zhurnal. Land-surveying bulletin: a science-industrial journal*. Access mode:[http:// www.academia.edu/10437865/3-D_CADASTRE](http://www.academia.edu/10437865/3-D_CADASTRE)

²¹ Ripenko A. (2010).

difference”. This attests to the fact that even such section of “empty space” may in some cases act as a specific property (commodity)²².

A similar phenomenon is also known in Great Britain. In this country, “flying freehold” denotes, in fact, part of the property (freehold), which was built over the part of somebody else’s property (a balcony over other owner’s balcony), or over the common territories and does not form a part of the “surface property”. Anyway, legal regulating of such kind of relationships cannot be defined as satisfactory and is a kind of anomaly²³.

Certain limitations of “vertical borders” of land parcels as objects of law existed in Greece. Here, realty is viewed as a real or an ideal section of space that constitutes autonomous or indivisible common property rights²⁴.

According to the 4th International Symposium on 3D cadasters materials, the numerous issues of 3D cadasters are quite actively discussed nowadays all over the world in various aspects: the legal, logical, organizational, and technological ones. Nevertheless, there is nowadays no country in the world that would have established a full-fledged 3D cadaster system for the whole of its territory. But the most developed countries are working hard on development of 3D and even 4D land cadasters models.

Cadaster systems are to be designed in the three spatial dimensions (the length, the width, and the height). Thus, preliminary studies of the Croatian 3D cadaster, considering the examples of the instances of its application, make it possible to think that it is essential to represent in 3D not only separate building located on the plots, but also to register in 3D their separate parts (flats, offices, etc.). Along with the three mentioned dimensions, there also exists the time aspect as well, that is the fourth dimension of realty, which should be accounted for when registering in cadaster system the land parcels having objects located thereon. For this purpose, the Croatian land resources management system was renovated and was partially represented by a 4D cadaster. Nevertheless, the land cadaster of Croatia is, for the most part, a two-dimensional system, which is supplemented by three recently designed 3D products, necessary for efficient use of this system. They are the geodesic information special database, the development of the permanent monitoring system, and separate accounts concerning realties and their separate parts. Efficient operation of the land cadaster is also possible due to a combined system of the land cadaster and that of realty resulting in a 4D cadaster system which, in its turn, gains more importance in the sphere of registration of general use infrastructure objects that form a certain integrated network, separate parts of which belong to different persons. Thanks to such a system, it becomes possible to monitor not only the current state of the land plot with all its objects, but also their state at any given moment in the past²⁵.

²² Ripenko A. (2010).

²³ Ripenko A. (2010).

²⁴ Ripenko A. (2010).

²⁵ Nikola Vučić. (2014) Towards 3D and 4D Cadastre in Croatia / Nikola Vučić, Miodrag Roić and Danko Markovinović // 4th International Workshop on 3D Cadastres. – Dubai, United Arab Emirates.

For instance, in Hungary, the land cadaster system is successfully developing and operating thanks to forming 3D cadaster maps on the basis of the unified land plots registration database and the modernized legislation in the sphere of land relations connected, mainly, with the appearance and recognition of the new type of property, “underground and overhead crossings, objects, structures, in relation to which there have been established uniform property relations, must be recognized as property to be registered in full extent and reflected in the land cadaster”²⁶.

Thus, the undertaken research in utilizing such systems and models in the area of land parcels account in the European Union demonstrates certain benefits from the application of the mentioned cadasters, particularly on the example of Croatia:

- 1) for the owners of land parcels this is an opportunity of obtaining information on the type and location of infrastructure objects constructed on their property and about the most proximate to their plots infrastructure objects and communications which can be utilized;
- 2) for state administration bodies, it is a possibility of a ready access to the main data concerning all infrastructure objects on their territory;
- 3) for the infrastructure objects’ owners, it is an improved protection system of general use objects from damage and ruining²⁷.

Of interest is the experience of land accountancy in Norway. The ability of utilizing the so-called “new lands” there is immediately related with obtaining a “building permit” for construction of any specific underground or overhead object. Therefore, a “3D plot” cannot be formed regardless of a specific building or construction. In such a way there is eliminated a possibility of registering some volume of air or a mountain for stake holding the property and reserving these areas for future use²⁸.

The topicality of introducing the 3D cadaster in Ukraine is stipulated by a number of reasons among which the following should be noted: 1) adoption of the Law of Ukraine “On State Land Cadaster”; 2) the transformation of the cadaster system (since 01.01.2013) into the State Geo-information System on the land resources of the country that will be a part of the designed infrastructure on the geo-spatial data of Ukraine; 3) the rapid evolution of cadaster systems in the world, which is based on the wide-scale

– 9-11 November 2014. – [Electronic resource]. – Access mode: http://www.gdmc.nl/3DCadastre/literature/3Dcad_2014_29.pdf.

²⁶ Gyula IVÁN. Towards 3D Land Registry in Hungary / Gyula IVÁN, András OSSKÓ // FIG Working Week 2015. From the Wisdom of the Ages to the Challenges of the Modern World. – Sofia, Bulgaria. – 17-21 May 2015. – [Electronic resource]. – Access mode: http://www.fig.net/resources/proceedings/fig_proceedings/fig2015/papers/ts08h/TS00H_ivn_ossk_7661.pdf.

²⁷ Nikola Vučić. (2014).

²⁸ Ripenko A. (2010).

introduction of geo-information systems and technologies; 4) transition from the existing Concept of cadaster development (“Cadaster 2014”) to the perspective “Cadaster 2034” system, which, in its turn, provides for transition to the 3D and 4D cadasters, cadaster information globalization and ecologic directedness of cadaster systems of the future; 5) worsening anthropogenic load on natural resources, dynamic changes in the state of land resources, urbanization processes, active development by mankind of the earth surface and the space over and under it; 6) the need in representing up-to-date, three-dimensional information on the objects at a given locality like multistoried buildings, engineering constructions, (placed one over another), underground infrastructure (subway lines and stations), and engineering objects (communication cables, water and gas supply systems, sewage systems), underground parking spaces and garages, tunnels, etc.; 7) the need in the introduction of the notion of property right in the space below and above ground level, which is stipulated by the requirements on registering all the elements of underground and overhead infrastructure²⁹.

Conclusions.

Forming an integrated cadaster system that would be closely connected with property registers, lands’ evaluation, and the quality of land will be a token of economic development of the state and its individual regions, of business and investment climate improvement. In its turn, the state land cadaster should become not only the system of registration, amassing, and generalizing the data on lands and territories, but also the system of account, management, and provision of a balanced development of the country.

Therefore, on considering the peculiarities in introduction and application of 3D land cadasters by different countries of the world, and having analyzed the benefits from such account-and-registration systems, it is possible to offer some recommendations concerning establishing of the 3D cadaster on the domestic territory.

First, it is necessary to improve the land legislation and adjust it to present-day needs. A particularly urgent is the need in a more precise definition of a plot of land, in drawing a dividing line on property rights on different objects located on the same plot of land and their parts, and a detailed regulation of the 3D cadaster system operation and of access to it.

Second, the land cadaster and the register of realties rights in Ukraine should be combined on the principle of integrated accounting systems in Hungary, which would contain exhaustive data regarding all rights on all the realty objects.

²⁹ Yeysiukov T., Krasnolutskyi O., Polischuk I. (2016). *Aktualnist i perspektyvy vprovadzhenia 3D kadastru v Ukraini* [Topicality and perspectives of the 3D cadaster introduction in Ukraine]. *Zemlevporiadnyi visnyk Land-management bulletin*. 2016, 2. 28-33.

Third, the introduction of the 3D cadaster should be accompanied by development of spatial maps and localities schemes based on constantly renewed information that should arrive through satellite communication systems. And, finally, financing of such a revolution in the sphere of land accounting and registration should not be done exclusively from the state budget, because in present-day conditions of Ukraine's economic development this will only hinder the innovation process; instead, it should take place with involving funds of large private commercial structures, which will gain considerable benefits from further prevention of conflicts and controversies arising from the imperfection of currently existing information and accounting systems.

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