

Research of the Land Surveying Industry in Ukraine through the Creation of an Electronic Register of Land Surveying Documentation

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Key words: land surveying, documentation, electronic archive, Ukraine

SUMMARY

Over the past three decades, after the collapse of the Soviet Union, Ukraine has carried out one of the most ambitious land reforms in Europe, which resulted in the division of 12 thousand collective farms of the socialist type and the formation of 6.9 million new land holdings on an area of about 27 million hectares, as well as the privatization of about 13 million land plots with individual residential buildings, peasant farms, garages, gardens and orchards. Land transformations became possible due to the implementation of a significant amount of land surveys and the preparation of relevant documents, which became the basis for the cadastral registration of new real estate objects, as well as property rights. Since 2004, all archives of land management documents have received the legal status of the State Fund for Land Surveying Documentation (SFLSD), and the organization of collection and storage of these documents is provided by the State Service of Ukraine for Geodesy, Cartography and Cadastre. As a result of the study, the digital database of the register of land surveying documentation, which has been maintained since 2009, was developed. It is shown that as of 2020, the SFLSD contains almost 9 million documents, of which electronic copies have already been created for 1.4 million documents. The study of the created electronic database made it possible to identify the stages of development of the land surveying market, the prevailing types of land surveying documents, as well as regional differences in the scale and pace of land surveying works. The structure of the unique identifier of land surveying documentation can be a source of important information about the time of creation of documentation, its type, type of customer and contractor, as well as the place of storage. As the archives of land surveying documentation are converted into electronic form, access to the archives is provided through e-government portal.

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1. INTRODUCTION

Formation of new land plots, spatial planning of territories, establishment of boundaries of administrative units (for example, settlements), determination of locations of restrictions in land use, cadastral accounting of real estate in many countries is resulting in creation of the special land surveying documentation. Such documentation then permanently stored by cadastral authority or local government in specially created archives as an official documentary source of information on the boundaries and characteristics of land and other objects of cadastral accounting. Such documentation becomes an important source of legally significant information in resolving land disputes, restoring the boundaries of land plots, performing works on division or merging of real estate objects, spatial planning of community territories, etc. Surveyors before performing new surveying works often perform a title search and analysis of planning and cartographic materials in such archives in order to minimize the risk of errors in the identification of land rights or boundaries of real estate.

Over the centuries, in many countries, such land surveying archives mostly were kept in paper, but in recent decades, the need to digitize such archives and transfer them into electronic form has become apparent. Such approach significantly simplifies access to land management information; increases benefit of relevant data, as well as creates additional guarantees for its safety. Paper archives are often lost due to emergencies, fires, and hostilities, while electronic archives, which are stored sparsely and in multiple copies, provide a more reliable way to store valuable land management information and access it more quickly and cheaply.

It should be specially noted that one should not equate the maintenance of land cadastral records and/or real estate cadastre with the maintenance of archives of land survey documents - although these sets of documents may be closely related, but in Ukraine, like many other post-Soviet countries, these are two different sets of documents and information.

Undoubtedly, the electronic transformation of land management archives is an ambitious and costly task, since such archives can store hundreds of thousands or millions of documents, each containing tens of sheets of text, graphics and maps. Usually, an electronic transformation project should be preceded by an inventory of archives of land survey documents, the purpose of which is to create a list of documents, assign unique identifiers to documents, and determine the locations of their storage.

As the electronic list or catalog of land surveying documentation is formed as a single database, new interesting opportunities appear for studying the land surveying industry. By analyzing such a database, the researcher can get information about how the structure of the performed land surveying has changed over time, what types of land surveying work prevailed in different regions of the country. Knowing the approximate cost of different types of land surveying work,

we can indirectly determine the volume of the market for land surveying services in different years and draw conclusions about the demand for certain land surveying works on the market. Ukraine, as a country with the largest territory among countries fully located in Europe, has large land resources (60.4 million hectares), divided among 25.2 million separate land holdings, of which 19.0 million are located in urbanized areas within the boundaries of settlements. Since the beginning of the 2010s, a gradual process of electronic cataloging and digitization of archives of land surveying documentation by state cadastral authorities began in Ukraine. The created electronic catalogs of land surveying documents are published in the form of open data sets, which made it possible to analyze the development of the land surveying industry in the country in time and in the context of regions.

2. RESEARCH METHODOLOGY

2.1 Cataloging of land survey documents

Archives of land surveying documents in Ukraine have been accumulated by state cadastral authorities since Soviet times. It should be noted that restitution is not applied to Ukraine and land ownership rights are not returned to those to whom they belonged before May 15, 1991. Thus, the documentation created before this date cannot serve as confirmation of property rights, but can be a source of valuable information about the boundaries of land plots used by citizens and legal entities.

But since 1991, after the collapse of the Soviet Union, Ukraine has carried out one of the most ambitious land reforms in Europe, which resulted in the division of 12 thousand collective farms of the socialist type and the formation of 6.9 million new land holdings on an area of about 27 million hectares, as well as the privatization of about 13 million land plots with individual residential buildings, peasant farms, garages, gardens and orchards. All these changes in the structure of land tenure took place on the basis of land surveying documentation, which was developed by land surveyors, after approval was stored in the archives of the territorial divisions of the state cadastral authority.

Since 2004, all archives of land management documents have received the legal status of the State Fund for Land Surveying Documentation (SFLSD), and now the State Service of Ukraine for Geodesy, Cartography and Cadastre provides storage of these documents. The first attempt to catalog the archives of SFLSD was made in 2009, resulting in lists of about 6 million records. In 2017, it was decided to ensure the assignment of registration numbers to each land management document received by the SFLSD and to compile new catalogs (lists) of land surveying documents to be published on the official website of the State Service of Ukraine for Geodesy, Cartography and Cadastre (<https://land.gov.ua>) and the Unified State Web Portal of Open Data (<https://data.gov.ua>). Each land survey documentation was assigned an 18-digit alphanumeric identifier (registration number), the elements of which displayed: (1) the year the documentation was created; (2) the documentation belongs to the main (national), regional or local collection of documents; (3) type of documentation; (4) storage region; (5) storage area or city; (6) serial number at the storage location.

Thus, today in Ukraine for researchers in the form of a set of open data, an electronic database (catalog) of land surveying documentation is available, in which, as of the end of 2020, there

were almost 9 million records, and for 1.4 million documents were available not only availability information, but also electronic copies.

For the purposes of this study, we used a database published on the website of the State Service of Ukraine for Geodesy, Cartography and Cadastre, which consists of 27 files in MS Excel format (one file for each region) with a total size of about 677 MB. Each file contains a catalog of land surveying documentation for a specific region, indicating the registration number of each documentation, its full name, as well as a mark on the availability of an electronic copy. It should be noted that for four regions - the Autonomous Republic of Crimea, the city of Sevastopol, as well as some parts of the Donetsk and Luhansk regions, which are temporarily occupied by the Russian Federation, the catalogs were not updated after 2014. A fragment of the catalog is presented in Table 1.

Table 1. Fragment of the catalog of surveying documentation of the city of Kyiv
(Original catalog is in Ukrainian)

№	Registration number of land surveying documentation	Name of land surveying documentation	Availability of the document in electronic form (yes / no)
...
3	2001PΦ13KBKB000005	Land management project for the allocation of land for the construction, maintenance and operation of the recreation area "Prydorozhnya" with a catering facility on the route St. Petersburg-Kiev-Odessa, 8 (1167 km) in the Desnyansky district of Kyiv	no
5	2003PΦ13KBKB000003	Land management project for the allocation of land to a private enterprise "Ankor" for the construction, operation and maintenance of a cafe with a summer playground General Rodymtsev street in Holosiivskyi district of Kyiv	no
...
7	2003PΦ13KBKB000005	Project of allotment of a land plot to the open joint-stock company "Kyiv Plant of Rubber and Latex Products" for operation and maintenance of buildings and structures of the plant at 6 Amurska Street in Holosiivskyi district of Kyiv	no
8	2003PΦ13KBKB000006	Land management project for the allocation of land to the cooperative of garage owners "Slavutych-1" for the operation and maintenance of garages on the 57 Rossiyska street in the Darnytskyi district of Kyiv	no
...

2.2 Processing of catalogs of land surveying documentation

For the purposes of this study, we processed the existing database of land surveying documentation by decomposing the registration numbers of each document and isolating the year of creation of the document and its type. Further, using the statistical functions of MS Excel, we received quantitative information for each region of Ukraine on the development of different types of land management documentation by year and type. The information on the

availability of electronic copies of documentation for each type of documentation was also analyzed.

3. FINDINGS AND DISCUSSION

Since Soviet times, on the territory of Ukraine, there has historically been a division of land surveying documentation into three types:

- (1) land management project - a set of economic, design and technical documents to justify the measures for the use and protection of land, which are expected to be carried out under such a project;
- (2) working land management project - a set of economic, design and technical documents for land use and protection, including calculations, description, drawings of technical solutions, estimates, the implementation of which is expected to be carried out within the period established by this project;
- (3) technical documentation on land management - a set of textual and graphic materials that define the technical process of measures for the use and protection of land without the use of design elements.

The first type of documentation implies the availability of design solutions when it is necessary to design new boundaries of land plots, territorial zones, restrictions on land use, settlements, etc. The second type is projects mainly related to environmental protection measures (transfer of the fertile soil layer during construction, reclamation of disturbed lands, land grazing of unproductive lands, etc.). The third type of documentation, which does not contain design solutions, is usually drawn up to provide cadastral registration of existing land plots or other cadastral objects. The first two types of documentation are usually more difficult to develop and cost more to the customer, while the third type of documentation is relatively cheap and is made mainly in cases where the owner or user of the land needs to enter information about it into the State Land Cadaster in order to be able to manage the land plot as property (sell, lease, change function, register an inheritance, etc.).

Traditionally, the SFLSD also stores technical documentation on normative land valuation (this is a specific type of land valuation work used in Ukraine as a basis for land tax collection and performed by surveyors).

In the course of our research, based on the information published by the State Service of Ukraine for Geodesy, Cartography and Cadastre, we have created a single database that contains 9.26 million unique records with descriptions of stored land survey documents. It should be noted that only 34.5 thousand land survey documents (or 0.4% of the total) are dated earlier than 1991 (when Ukraine gained independence and began land reform). Thus, it can be concluded that paper land surveying documents of the Soviet era were largely not preserved or were lost.

As a result of the classification of records by types of land survey documents, we were able to quantitatively characterize the structure of land surveying work in Ukraine for the period 1991-2019, as well as calculate the number of deliveries of different types of land survey documents to the SFLSD for five-year periods (Table 2). These summarized quantitative data characterize the structure of the land surveying industry market in Ukraine and its dynamics over time rather indicatively.

Table 2. Creation of land surveying documentation in Ukraine in the period 1991-2019 with average annual deliveries for five-year periods

Types of land management documentation stored in the SFLSD	Total number	Average annual number of documents:					
		2016-2019	2011-2015	2006-2010	2001-2005	1996-2000	1991-1995
1. LAND MANAGEMENT PROJECTS							
Establishment of the state border	35	–	3,2	2,6	0,8	0,2	0,2
Organization and establishment of boundaries of areas of environmental, health, recreational and historical and cultural purposes	142	0,2	3,8	7,2	13,8	2,4	1,0
Establish and change the boundaries of regions, districts	1	–	–	–	–	0,20	–
Regional land use and protection programs	142	4,6	3,2	17,6	1,4	0,2	1,4
Land management schemes and feasibility study of land use and protection of districts	391	3,8	38,0	29,4	4,4	2,40	0,2
Establishing and changing the boundaries of settlements	8543	124,6	106,0	54,0	126,2	247,8	1050,0
Establishment and change of boundaries of territories of nature protection, health-improving, recreational and historical-cultural purpose of local significance, forestry purpose, lands of water fund and water protection zones, restrictions in use of lands and their regime-forming objects	723	13,6	45,2	55,0	10,8	5,6	14,4
Other land management projects at the regional level	2936	5,6	159,0	187,2	34,0	58,6	142,8
Demarcation of lands of state and communal property of settlements	875	2,8	142,4	20,0	2,0	1,0	6,8
Allocation of land plots	1347305	95489,0	93762,8	51466,8	20487,2	4865,2	3390,0
Creation of new and streamlining of existing land tenure and land use	2638	33,6	99,2	139,0	75,0	82,2	98,6
Ecological and economic substantiation of crop rotations and land use	2108	273,6	70,8	37,4	11,0	3,6	25,2
Landscaping of settlements	972	5,2	5,2	10,8	11,2	72,0	90,0
Privatization of lands of state and communal agricultural enterprises, institutions and organizations	123	1,0	3,0	1,6	1,8	4,4	12,8
Organizations of the territory of land shares (units)	9113	183,8	328,4	672,0	456,2	172,4	9,8
Landscaping for urban needs	112	20,6	1,0	–	–	0,2	0,6

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Types of land management documentation stored in the SFLSD	Total number	Average annual number of documents:					
		2016-2019	2011-2015	2006-2010	2001-2005	1996-2000	1991-1995
2. WORKING LAND MANAGEMENT PROJECTS							
Working land management projects	5218	51,6	268,8	446,2	122,8	49,4	104,8
3. TECHNICAL DOCUMENTATION ON LAND MANAGEMENT							
Establishing the boundaries of the land plots (on the ground)	2631726	235727,0	222230,6	42943,6	16198,0	6859,8	2386,2
Preparation of documents certifying the right to land	4615918	8665,6	172277,0	515270,8	162216,4	56841,8	7912,0
Special thematic maps and atlases of the state of lands and their use	3192	42,8	30,4	157,8	152,4	82,0	173,0
Land inventory materials	78568	1751,8	2679,2	2670,0	4325,6	3033,8	1253,2
Other types of land management documentation	277892	1562,2	10861,8	13665,4	13707,0	11744,4	4037,6
Establishing the boundaries of the part of the land plot to which the sublease rights and easements apply	4661	450,4	443,2	31,6	1,6	5,20	0,2
Division and consolidation of land plots	54183	7196,0	3405,0	159,2	43,6	32,0	0,8
4. LAND VALUATION DOCUMENTATION							
Materials of land valuation works	183158	6065,4	10962,4	11053,8	6567,6	1836,0	146,4

The analysis of the data obtained allows us to conclude that almost 50% of the documentation stored in the archives is the documentation was developed for the registration of legal titles to land plots, which is very typical for the active phase of land reform (1990s and 2000s). 28.5% of the stored documentation was created when establishing (restoring) the boundaries of land plots on the ground. Usually, such documentation is developed to enter information about already existing land plots in the State Land Cadastre. 14.6% were land management projects for the formation of new land plots, which in Ukraine are usually drawn up to provide land plots to citizens and legal entities, as well as during development when changing the function of land plots. Considering the dynamics of the performance of different types of land surveying over time, one can note a steady increase in the number of works to restore the boundaries of land plots and new land allotments.

Fig. 1 shows the annual dynamics of the supply of land surveying documentation in Ukraine. We can note a "peak" in the land surveying market in 2008-2009, which was due to the implementation of the government campaign for the registration of title documents for land for citizens at the expense of the state budget. In the future, the volume of the market is gradually decreasing, which, in our opinion, is due to the filling of the database of the State Land Cadastre and the decrease in the number of unregistered plots where land surveying is usually carried out.

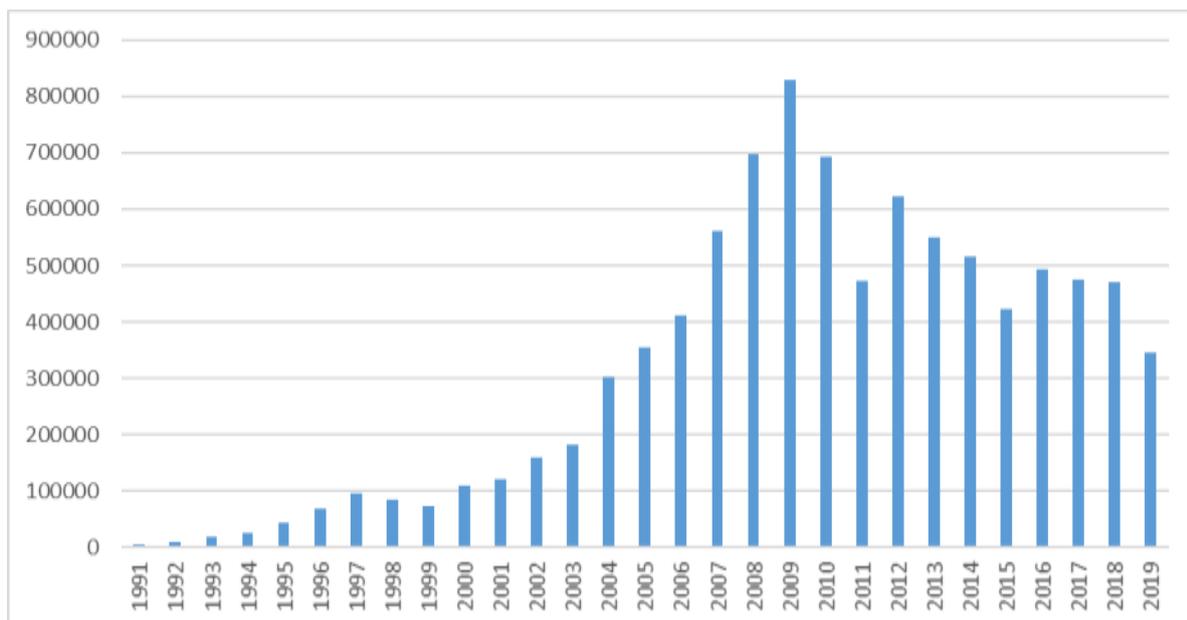


Fig. 1. The number of annually developed land surveying documentation in 1991-2019 in Ukraine

We also analyzed the structure of the land surveying documentation in the archives in the context of the regions of Ukraine, which allows us to identify parts of the country with a more or less developed market for land surveying services (Table 3).

Table 3. Distribution of surveying documentation archives by regions of Ukraine

Name of the region	Number of land surveying documents, thousand	Number of documents per 1,000 hectares	Change in market volume for 2000-2019, %
Autonomous Republic of Crimea	139,5	53,5	-100,0
Vinnitsa region	456,1	172,2	695,8
Volyn region	381,7	189,5	61,5
Dnipropetrovsk region	560,5	175,6	10,2
Donetsk region	213,0	80,3	318,0
Zhytomyr region	327,3	109,7	341,6
Transcarpathian region	263,3	206,5	434,6
Zaporizhzhya region	351,1	129,1	11,2
Ivano-Frankivsk region	425,6	305,6	433,2
Kyiv region	560,0	199,1	214,3
Kirovohrad region	375,7	152,8	575,5
Luhansk region	144,4	54,1	639,8
Lviv region	502,9	230,4	311,3
Mykolaiv region	262,8	106,9	405,4
Odessa region	420,1	126,1	57,0
Poltava region	708,4	246,4	139,5
Rivne region	383,3	191,2	344,6
Sumy region	335,1	140,6	465,3

Name of the region	Number of land surveying documents, thousand	Number of documents per 1,000 hectares	Change in market volume for 2000-2019, %
Ternopil region	324,9	235,0	438,8
Kharkiv region	334,7	106,5	264,3
Kherson region	212,2	74,5	249,8
Khmelnysk region	362,4	175,7	412,3
Cherkasy region	533,3	255,0	79,0
Chernivtsi region	264,6	326,9	747,5
Chernigiv region	327,8	102,8	48,5
Kyiv	16,3	194,7	19750,0
Sebastopol	68,2	789,7	-100,0
Ukraine	9254,9	153,3	217,4

The regions in which Ukraine has performed the largest amount of surveying work (over 500 thousand of documentation each) are Poltava, Dnipropetrovsk, Kyiv, Cherkasy and Lviv regions. All these regions have intensive agricultural land use and a dense settlement network. The regions in which Ukraine has performed the largest amount of surveying work (over 500 thousand units of documentation) are Poltava, Dnipropetrovsk, Kyiv, Cherkasy and Lviv regions. All these regions have intensive agricultural land use and a dense settlement network. The largest number of land surveying documents per unit area (over 200 documents per 1,000 hectares) are in the western regions of Ukraine, which have dense settlement network, and therefore a greater need for land surveying to meet the needs of local people in securing legal land titles.

4. CONCLUSIONS

Electronic catalogs of archival land surveying documentation can be used not only for searching and delivering land survey documents to consumers, but also for indirectly assessing the level of development of the land surveying industry both in the national and regional dimensions. The structure of the unique identifier of land surveying documentation can be a source of important information about the time of creation of documentation, its type, type of customer and contractor, as well as the place of storage. An analysis of the contents of archives of land surveying documents in Ukraine shows that over the past three decades, the country's land management industry has been primarily focused on serving the needs of land reform and the processes of mass privatization of land and registration of title deeds to land plots. The data obtained can be used to predict local markets for land surveying services, as well as monitor market trends, which will allow land surveyors to track the massive needs of consumers from the public and private sectors, as well as adapt their activities to them.

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BIOGRAPHICAL NOTES

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