LATVIA UNIVERSITY OF LIFE SCIENCES AND TECHNOLOGIES

UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN (Poland)

VYTAUTAS MAGNUS UNIVERSITY (Lithuania)

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FOREWORD

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The journal includes original articles on land administration, land management, real property cadastre, land use, rural development, geodesy and cartography, remote sensing, geoinformatics, other related fields, as well as education in land management and geodesy throughout the Baltic countries, Western and Eastern Europe and elsewhere. The journal is the first one in the Baltic countries dealing with the mentioned issues.
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CONTENT

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PRACTICAL APPLICATION OF SURVEYING METHODS FOR DETERMINATION OF VOLUME QUARRY MINING

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Abstract
Nowadays, various types of geodetic measuring instruments are available in surveying. When conducting a survey of a terrain, surveyor must choose a survey method that is capable of providing high precision measurements. In the surveying process, it is possible to use the following measurement methods - tachymetric survey method, positioning method and remote sensing method. Each of the methods produces data formats that can be used further for volume calculations.
The paper analyses the volume differences that are obtained when using various survey methods and volume calculation programs to obtain the surface model. The use of such a tool is important for useful mineral miners, so that surveyors make qualitative surveys and obtain accurate and reliable volumes.
Useful minerals miners are required to report annually on their mining volume for a specified period. The useful minerals miners shall at all times keep records of the quantities of minerals actually extracted. Regardless of the type of accounting, topographic surveying and the calculation of volumes, if mineral is extracted in mineral deposits of national importance, more than 50 000 m^3, are required (Augstas detalizācijas topogrāfiskās…, 2012). High-quality and accurate topographic survey is needed to create the most realistic surface model appropriate to the terrain. It is defined that the difference between the volumes obtained from the recording of vehicle loads should not be more than 5% when comparing the result of the mineral extraction from topographic surveys (Derīgo izrakteņu ieguves…, 2012; Noteikumi par valsts…, 2018).
Nowadays, various measurement methods can be used to obtain data from which a surface model can be generated, and this model can then be used for volume calculations. The surface model is a set of points where, in addition to plane coordinates (x and y), there is also altitude (z) known (Luukkonen, 2011). Each measurement method has its own different measuring instruments that can be used, each method has its own operating principles, on which the quality and accuracy of the obtained data depends.
Key words: Quarry mining, tachymetric surveying methods, GNSS, remote sensing, surface model.

Introduction

Nowadays, various measurement methods can be used in order to obtain data set from which a surface model can be generated. Surface model is a set of points, where in addition to coordinates of the horizontal plane (x and y), also component of altitude (z) is known (Luukkonen, 2011). In order to obtain a surface model, various measurement methods can be applied. In connection to importance of useful minerals in the economics of the state in general, it is important to carry out accurate measurement of their volumes. For each measurement method diverse measurement instruments shall be used, each method has its own operating principles. Quality and accuracy of obtained data depend on them.
Measurement here is a set of geodetic works, which result in obtaining of data necessary for compiling of plans, maps and profiles. They are lengths of lines, angles and altitudes of points. According to aim of a measurement, vertical, horizontal and topographic measurement is distinguished.
There is need to perform a topographic measurement in terrain, in order to obtain data on situation in terrain and marks of altitude. In the paper, authors view three different measurement methods:

1. Tachymetric measurement method;
2. Global positioning method;
3. Remote sensing method.

Regulations No. 281 of the Cabinet of Ministers of the Republic of Latvia "Regulations on topographic information of high detail and its central database" (Augstas detalizācijas topogrāfiskās…, 2012) determine procedure, in which topographic measurement of objects shall be performed. Regardless of the measurement method, surveyor shall perform topographic measurement in geodetic coordinate system of Latvia of year 1992– LKS 92. It is expressed in plane coordinates of Mercator transversal projection. In the territory of the Republic of Latvia, European Vertical reference system is realized. Height system in Latvia is normal height system epoche 2005,5 – LAS-2005,5 (Ģeodēziskās atskaites

sistēmas…, 2011). When the measurement works are performed, surveyors shall use geodetic instruments, for which controls are performed and which complies with accuracy requirements set by manufacturers (Matos, Goncalves, 2003).
When a topographic measurement is performed in terrain, it is possible to use beforehand obtained topographic information on the given territory. If measurement in the territory in question is performed repeatedly, it is determined that difference of coordinates and altitudes shall not exceed – 30 cm for coordinates in horizontal plane and 20 cm for component of altitudes for contours and objects of the situation, which are not explicit. In a terrain with explicit contours and objects, requirements are 5 cm for coordinates in horizontal plane and 3 cm for altitude components (Derīgo izrakteņu ieguves…, 2012; Noteikumi par valsts…, 2018).
In the process of application of measurement methods, for the calculation of volumes of quarrying, specialized software is used, where it is possible to perform calculations of volumes of various types. As it is determined in the Regulations No. 570 of the Cabinet of Ministers of the Republic of Latvia "Procedure of mining and quarrying", in necessary requirements for mining and quarrying and accounting of useful minerals, if miner of the useful mineral wins more than 50 000 m^3, regardless of the type of accounting it is necessary to ensure topographic measurement, as well as calculation of volumes acquired within calendar year.
Result of calculation of volumes of minerals depends on the accuracy of the obtained surface model that is used as the base for calculation of obtained volumes. When topographic measurement of location of useful minerals is performed, in various periods of time, difference of results of volumes shall not be greater than 5% of results, where accounting is performed according to vehicle cargos. Surveyor, when he carries out topographic measurement and uses some measurement method shall obtain data volume of high quality as possible, because only from field data of high quality it is possible to obtain accurate and plausible surface model. It is possible, if field measurements are performed complying with method for obtaining of measurement data as accurate as possible. This applies to application of any measurement for the obtaining of surface model.
When authors worked with this research, purpose of the work was set – to study differences of volumes of mining of quarries by use of diverse measurement methods. In order to achieve the purpose of the research, work tasks were set as follows:
1. Description of the quarry of mining of useful minerals;
2. Applied measurement methods, when quarry was measured, in different periods;
3. Usage of obtained geospatial data in the determining of volumes of mining of useful minerals;
4. Analysis of results and proposals.
Materials of the research could be used in surveying enterprises that deal with improvement of methodology of accounting of volume of extraction of minerals.

Methodology of research and materials

For the comparison and control of extracted volumes of useful minerals, surveyor performs measurement of territory of quarries in order to calculate volume from the obtained measurement data. In the research, measurement of the territory of the quarry "Akmenscucinas" of the dolomite deposit "Iecava" (Fig. 1).

Fig. 1. Location of the quarry "Akmenscucinas" of the dolomite deposit "Iecava" in Latvia.

In the quarry "Akmenscucinas", field measurements were performed by three different measurement methods. Further the obtained measurement data were processed by volume calculation software "Virtual Survey" and "Bentley Microstation Powersurvey V8i".
Owner of the quarry "Akmenscucinas" of the dolomite deposit "Iecava" is state joint stock company "Latvijas autocelu uzturetajs" that manages the quarry. License for subsoil use is assigned to state joint stock company "Latvijas autocelu uzturetaājs", where is defined that in deposit "Iecava", useful mineral dolomite in the time period from year 2014 until 2039 can be extracted. The quarry is located about 9 km to southwest from Iecava and about 27 km to southeast from Jelgava. The total limit of extraction in dolomite deposit "Iecava" is set 2206.13 thousand m^3.
In the course of realization of the research, three different measurement methods for the registration of volume of extraction of the quarry were used – tachymetric measurement method, GNSS positioning method and remote sensing method (use of unmanned aircraft).
Tachymetric measurement method. In the measurement method, electronic tachymeter Leica TCR805power was used. For performance of measurement works, points of support geodetic network were installed. Coordinates for support network points were obtained by measurement by use of GNSS receiver set Leica GX1230. When tachymetric measurement was conducted, fixations of the measurements were performed so that it would possible to characterize the surfaces of the quarry at the given moment as close as possible.
GNSS positioning method. When positioning method was applied, GNSS receiver Leica GX1230 was used. In measurement by GNSS method, eventual adverse effects of multiple signal reflection in the specific location, as well as other factors affecting the accuracy shall be considered. Before the performance of measurements, planning works were carried out in order to obtain availability of optimal number of satellites and optimal position in the selected location and at the selected time. Measurement was performed in Real Time Kinematic (RTK) mode, in framework of LatPOS base support system. When GNSS RTK measurement was conducted, fixations of the measurements were performed so that it would possible to characterize the surfaces of the quarry at the given moment as close as possible.
Remote sensing method. In the realization of this method, unmanned aircraft DJI Phantom4 with photogrammetric camera was used. As the quarry was measured several times, each time before the performance of the flight, ground control points (GCP Plates (40x40 cm)) were placed in homogenous manner. GCP were measured in every measurement session and linked to the defined coordinate and height systems in Latvia. Such approach ensured measurement of the surface of the quarry in unified spatial reference system and enabled to calculate correctly the volumes of extracted deposits (Bosas *et al.*, 2013). Height of the flight in the measurement process was set to 50m, as well as coverage of photography during the flight was defined, the frontal coverage - 80%, the lateral coverage – 70% (Digitālā virsmas modeļa…, 2014; Lukss, 2017).
Measurement campaigns in the quarry "Akmenscucinas" of the dolomite deposit "Iecava" in 2018 were organized three times (Table 1).

Table 1

Measurement methods and time of performance

Measurement method	Year 2018		
	July	October	December
Tachymetric measurement method	✓	✓	✓
GNSS positioning method	✓	✓	✓
Remote sensing method	✓	✓	✓

By methods described above, models of surface of the quarry on specific date were obtained. By use of the surface models obtained, it was possible to perform calculation of volumes of extracting of useful minerals. Principle of calculation of volume of extraction of useful minerals is based on the obtained surfaces on different dates of measurement (Jawecki *et al.*, 2019; Kubodera *et al.*, 2017). Body is obtained in the result, volume of which characterizes volume of extraction of useful mineral between two dates of measurement. (Fig.2).

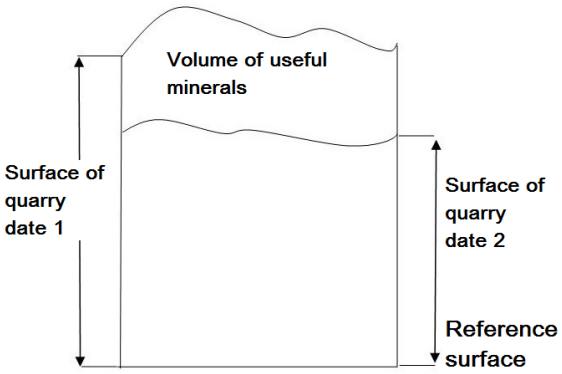


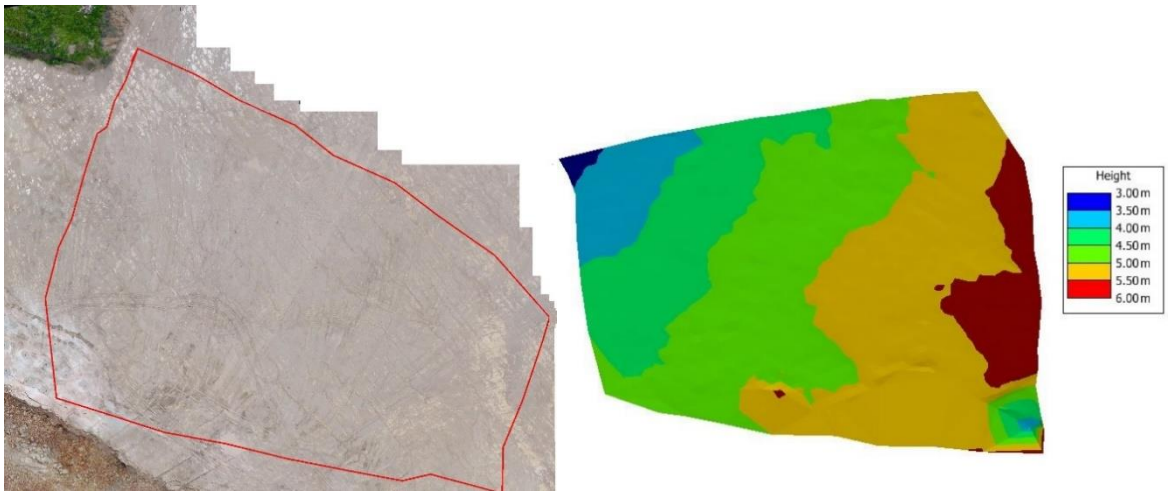
Fig. 2. Principle of calculation of volume of useful mineral

Discussions and results

The applied surface measurement methods give the necessary data, from which it is possible to create surface model. The obtained data further were calculated by use of geospatial software package "Virtual Survey" and "Bentley Microstation Powersurvey V8i". Hence, from data of each measurement method, surface models were obtained by use of both geospatial packages.

In July 2018, first measurement stage of the quarry was organized. In this case, situation to be measured in the terrain was before extracting of useful mineral, consequently the surface was without sharp changes of relief. Obtained average elevation difference between GNSS positioning and tachymetric measurement method is 1-2 cm, in some places up to 5 cm. Elevation differences between measurement methods can be explained with the fact that surveying rod was placed in different places. Horizontal and vertical accuracy of measurements of GNSS positioning method was not worse than 1cm. Such accuracy was observed also in measurement cycles of October and December. If we compare the obtained elevation values between remote sensing and GNSS positioning/tachymetric measurements, we can see that the difference of elevations is up to 3 cm.

According to data of results of the applied measurement methods, surface models in the software environment "Virtual Survey" and "Bentley Microstation Powersurvey V8i" were obtained. In Fig. 3, surface model according to data obtained by DJI Phantom4 is shown.

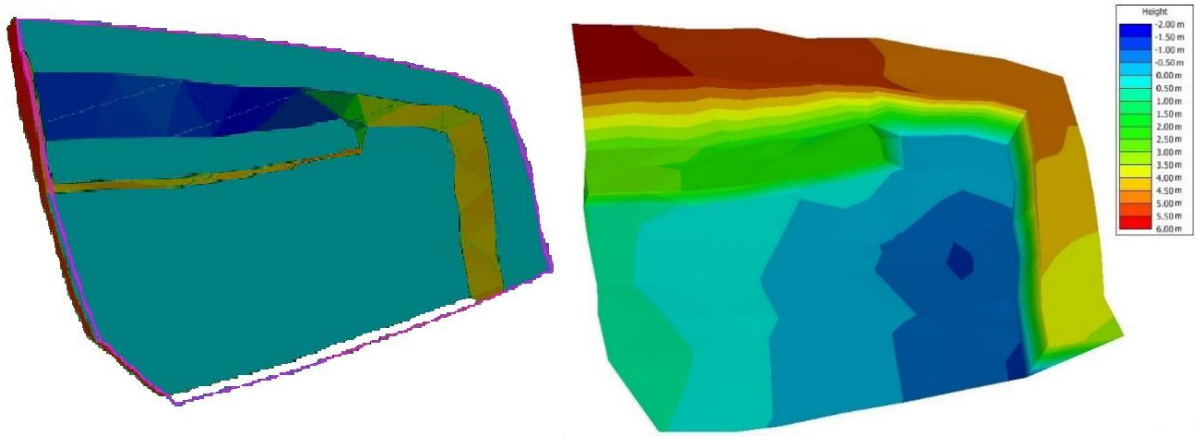


By use of "Virtual Surveyor" By use of "Bentley PowerSurveyV8i"

Fig. 3. Surface model according to DJI Phantom4 data in July 2018.

In October and December 2018, second and third stage of measurement of the quarry was organized, by use of three measurement methods. According to measurement data, surface models for the territory of the quarry in software environment "Virtual Survey" and "Bentley Microstation Powersurvey V8i" were obtained. Possibility to carry out visual comparison of the created models arose. For example, if we

compare the created models according to data of tachymetric measurement method in October, the model that is developed by "Bentley PowerSurveyV8i" (Fig.4) is better perceptible visually than the model developed by the other geospatial program.



By use of "Virtual Surveyor" By use of "Bentley PowerSurveyV8i"

Fig. 4. Surface model according to data of tachymetric measurement in October 2018.

In the surface model according to "Virtual Surveyor", detailing in even planes is smaller. Nevertheless, regardless of the data visualization usage of both programs ensures full-fledged numerical file that enables calculations of various types.

As from July extraction of the useful mineral – dolomite was performed, the extracted volumes were calculated according to surface models created by measurement data. Calculations of volumes of extraction of useful minerals were carried out by use of the surface models obtained. In each program of processing of geospatial data, identical data (x,y and z coordinates), which were obtained in each stage of measurement, were placed. Thus the obtained results are mutually comparable and can be analyzed. Calculations of extracted useful volumes and their differences between measurement stages are summarized in Table 2.

Table 2

Calculations of extracted useful volumes and their differences between measurement stages

Measurement method	**Calculation of values by "Virtual Surveyor" (m^3)**		**Calculation of values by "Bentley PowerSurvey V8i" (m^3)**		**Differences of extracted volumes (m^3)**	
	July October	**October December**	**July October**	**October December**	**July October**	**October December**
Tachymetric measurement method	19555	3948	19473	3805	82	143
GNSS positioning method	19712	3924	19614	3792	98	132
Remote sensing method	18835	3654	18663	3611	172	43

If we analyze the obtained results, we can see differences of extracted volumes between measurement methods. Differences of extracted volumes according to tachymetric measurement method for period October-December are greater than for period July – October. Such tendency could be observed for differences of volumes of extraction of GNSS positioning measurement data. This can be explained with factor that in the first stage of measurement in July active extraction in the quarry was not started.

Therefore, the surface to be measured in July was even, without sharp forms of relief. In measurements of October and December, the surface to be measured was after performed rock blasting works for the extraction of dolomite. Therefore, measurement of the relief by use of Tachymetric and GNSS Positioning Method is challenge for very uneven surface covered by dolomite debris. It is difficult to measure from 4 m up to 8 m wide parts of blasted dolomite.
Differences of extracted volumes according to Remote Sensing Method in period July – October are fore times greater than in period October – December. It is possible that it is related to effects of some type in the measurement process. In the Remote Sensing Measurement Method, unmanned aircraft in the course of flight fixes images on the entire situation in the terrain, and in surface model, information also on blasted parts of dolomite appears.
As the research was developed, we can see that accounting of extraction of useful minerals is possible by use of different geodetic measurement methods. Each of methods has different preparation, measurement and field data processing processes. Therefore, as work performer carries out measurements, it is possible to obtain measurement product by use of measurement and data processing methods and programs of different type. It is important that as measurement procedure is carried out, control procedure is ensured, thus it is ensured that credibility of the end product is as high as possible.
As accuracy of measurements in the Tachymetric Measurement Method was analyzed, it was not worse than 5mm. Accuracy of GNSS measurements was not worse than 1cm. Accuracy of measurements of remote sensing was not worse than 5cm. If we take into account the exactness of results of measurements, we can see the differences of obtained volumes of surface models in “Virtual Survey” and “Bentley Microstation Powersurvey V8i” program environment. As input data in both program environments were identic, results show that volumes of useful minerals are greater in “Virtual Surveyor” program environment. We can see that the factor that affects the volume of the useful minerals is the structure of the algorithm of the used programs, which ensures the corresponding value.

Conclusions and proposals

1. Tachymetric measurement method can be used under any circumstances and in any terrain situation, where surveyor with equipment has access. The method does not depend on terrain circumstances, GNSS visibility, GSM communication system coverage.
2. GNSS positioning method can be used full-fledgedly at “open horizon” and perfect GSM communication system coverage.
3. Usage of remote sensing method ensures obtaining of homogenous surface model. Important factors of the measurement method are climatic circumstances and surveyors experience.
4. Results show that the selected measurement method is the main factor affecting the accuracy the depiction of useful minerals, surface of quarries.
5. Differences of values of volumes of useful minerals between “Virtual Survey” and “Bentley Microstation Powersurvey V8i” do not exceed 5%. The obtained results of the study show, that in calculations of volumes both program packages shall be used, as it is prescribed in Regulations of the Cabinet of Ministers of the Republic of Latvia No. 570, on “Procedure of extraction of useful minerals”.
6. For the calculation of volume of useful minerals, measurement method with the highest accuracy that can be achieved shall be applied by use of corresponding technical equipment and data processing software. In the measurement process, control mechanism of the obtained results shall be ensured.

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DEVELOPMENT OF HIGHER ENGINEERING EDUCATION IN RUSSIA IN THE CONTEXT OF BOLOGNA PROCESS

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Abstract
The process of reforming higher education in Russian Federation continues. One of the main areas of these reforms is an introduction of principles of Bologna process into Russian higher education system. It was launched after Russia ratified the Bologna Declaration in 2003. Since the beginning of reforms and up to now there have not been lingering disputes about feasibility of introducing the principles of Bologna Agreement into higher education. The article deals with the history of reforms on the example of higher education in land management in Russia. Dynamics of indicators of higher education institutions which carry out training under programs in the field of land management and cadastre have been studied. Introduction of federal state educational standards associated with introduction and/ or updating of current education within Bologna process in 2020 has been considered. Updating (introduction of FGOS 3++ standard) will be implemented in all directions of bachelor degree. First of all it is guided to consideration of requirements of professional standards. The process of development of the Institute of State Accreditation of higher education institutions of Russia, its current status and problems faced by higher education institutions during accreditation process have been studied.
Key words: Bologna Process, engineering education, higher education reform, integration, land management education.

Introduction

Bologna process in European higher education was launched more than 20 years ago, when Bologna Declaration (Joint Statement of European Ministers of Education "European Higher Education Area") was signed on June 19, 1999. Declaration outlined short-term goals, which were supposed to lead to creation of zone of European higher education and promotion of the European system of higher education around the world (Bologna Declaration…, 1999).

The most important objectives of modernization of higher education in Bologna Process were set as follows:

- developing education on the basis of two levels (Bachelor's and Master's degrees);
- introducing a credit system of credit points (ECTS);
- expanding mobility both of students and teachers;
- controlling the quality of education;
- ensuring an employment of graduates;
- promoting European dimensions in higher education;
- making the European education system more attractive.

Integration processes in higher education included first EU Member States and later – other countries within continental Europe and their neighbouring countries. Currently Bologna Process is the largest higher education reform in the history of Europe.

Russian Federation joined to Bologna Process in September 2003 on Berlin Conference, and commitments were made to introduce the basic principles of the Bologna process into higher education until 2010. Since the Bologna Process started, higher education system in Russia has undergone fundamental changes. Integration process is going rather slowly and painfully, there causes many disputes about its expediency, which is noted not only for the Russian Federation, but also for many post-Soviet space countries.

Since September 1, 2009, four-year bachelor's programs were introduced in all higher education institutions in Russia, followed by a master's degree, and admission to a five-year specialist course in most areas was stopped. At present, more than 15 years have passed since Russia's accession to the Bologna Process and some conclusions can be drawn on the development of higher education (Drunk, 2009; Артамонова и др., 2015; Власов, Васильева, 2015; Пьянова, 2009). Assessment of this process

within higher education community is not unequivocal but there more criticism is dedicated to implementation of the reforms (Востриков и др., 2018; Хеккерт, Боран-Кешишьян, 2019; Чугунов, Ильясова, 2019; Шолохов, 2019).

Implementation of Bologna agreements causes contradictory assessments not only in Russia, but also in Europe. The education scheme proposed by Bologna Declaration differed greatly from the Russian education concept inherited from the Soviet period. The aim of the article is to study development of higher engineering education in Russia under Bologna process implementation conditions on the example of study direction "Land management and cadastre". For this purpose the existing system of training of land surveyors in Russia and characteristics of higher education institutions preparing them have been studied, the changes which have taken place in higher education of the country as a whole, and also in the field land surveyors training during the reforms have been considered, as well as development of the institute of state accreditation of higher education institutions of Russia, its current state and problems have been analysed.

Methodology of research and materials

Materials of annual statistical reports published by Federal State Statistics Service of the Russian Federation (Rosstat) have been analyzed. Summary data published by Educational and Methodological Council on Education in the field of land management and cadastre have been studied.

Discussions and results

To implement the land reform, which started in Russia in 1990, there was need for large number of professional staff - cadastre and land management specialists. Land management education in Russia has long history - in 2019 the State University of Land Management (in Moscow) celebrated its 240th anniversary. University was established in 1779 to teach specialists for land reform in Russia [Известия…, 2019]. The University graduates have carried out land reforms, large-scale works on land surveying and rational use of land. Nowadays State University of Land Management is the basic higher education institution in Russia in preparation of bachelors and masters in direction "Land management and cadastre". At the University there has been created Educational and Methodical Council (further – EMC). It is attended by representatives of universities from different regions of Russia, where students have been prepared in this field. At present the number of appropriate universities has increased significantly. In Soviet period on territory of Russian Federation there were 5 universities in land management, in 2019 – 107 (Table 1).

Table 1

Dynamics of number of higher education institutions in direction of studies "Land management and cadastre"

Indicators	Year		
	2017	**2018**	**2019**
Total number of universities, including:	**98**	**104**	**107**
- under Ministry of Agriculture of Russia	37	40	40
- under Ministry of Education and Science of Russia	61	64	67
Total number of universities – members of EMC, including:	**94**	**98**	**100**
total number of students enrolled, including:	**6980**	**7295**	**7244**
- bachelor studies	5528	5697	5799
- Master studies	1395	1527	1387
- PhD studies	57	71	58
total number of graduates	**6097**	**5933**	**6216**
- bachelor studies	5379	4963	5026
- Master studies	672	936	1159
- PhD studies	46	34	31
Annual total number of students (from enrollment to graduation)	**25593**	**26873**	**25400**

Source: data of EMC (Подготовка кадров…, 2020)

In general, due to beginning of land reform in Russia, enrolment of students into higher education institutions for surveying studies has increased significantly. In 1991 throughout the country, there were only 675 enrolled students, because only 4 universities in the Russia prepared specialists in land surveying, land management and cadastre. When the land reform began, there come out the lack of specialists who could carry it out. Urgently were opened appropriate study programs - first in agrarian universities, then in others. In 2019 total number of enrolled students in bachelor, Master and PhD studies exceeded 7 thousand.

As showed data of EMC, in 2019 number of enrolled bachelor level students is more than 4 times higher than number of enrolled Master level students. Less than 30% of bachelor level graduates continue their studies at Master level on speciality "Land Management and Cadastre". In Russia it is allowed to study on Master level after obtaining of Bachelor's degree or having the diploma of engineer – land surveyor (before implementation of Bachelor's degree). On Master level studies can be enrolled not only land management and cadastre specialists, but graduates with Bachelor's degree of the same kind of specialities.

Studying the location of higher education institutions according federal regions of Russia, there can be noted significant differences - the maximum number are located in Tsentralnyy (24) and Privolzhskiy (21) region, the minimum number – in Dalnevostochniy (9), Uralskiy (9) and Severo-Kavkazskiy (8) region (Table 2)

Table 2

Breakdown of universities having study programs in field of land management and cadastre (2019)

Federal region *(Oblastj)*	**Number of universities**			**Number of universities teaching in land management and cadastre**	**Number of study programs**			**Number of universities having part-time studies**	**Number of teachers**	
	total	**including**			**on bachelor level**	**on Master level**	**on PhD level**		**total**	**incl. professors and assoc. professors**
		Ministry of Education and Science	**Ministry of Agriculture**							
Dalnevostochniy	9	5	4	9	9	7	0	7	82	50
Privolzhskiy	21	10	11	21	21	12	1	17	273	207
Severo-Zapadniy	13	12	1	12	13	7	3	9	161	125
Severo-Kavkazskiy	8	4	4	8	8	6	1	8	88	68
Sibirskiy	11	7	4	9	11	9	4	8	194	138
Uralskiy	9	6	3	9	9	3	3	7	91	64
Tsentralnyy	24	15	9	21	22	12	6	20	400	299
Yuzhnyy	12	8	4	11	12	7	2	10	128	107
Total	**107**	**67**	**40**	**100**	**105**	**63**	**20**	**86**	**1 417**	**1058**

Source: data of EMC (Подготовка кадров…, 2020)

Data show that number of universities which realised enrolment in 2019, is higher than number of universities which in realised graduation. This fact indicates that in recent years the licensing process and opening of new bachelor and Master study programs in field of land management and cadastre is going on in Russia. At the same time the total number of universities in Russia has decreased from 1115 in academic year 2010-2011 to 742 in academic year 2018-2019 (Российский статистический ежегодник, 2018). Reduction in the number of universities by 33% coincided with reduction in number of students by 41% due to negative demographic tendencies. Licenses of ineffective educational institutions were nullified by the Ministry of Education as well. Number of professors and teachers has also decreased (Пинтаева, 2019).

In early 1990s training of specialists in field of land management and cadastre was carried out according to only curriculum of specialty "Land management" (5 study years), which was approved by Ministry of Agriculture of the Russia. This curriculum clearly defined study disciplines, field practices and practical trainings. In 1992 there started an experiment for implementation of multilevel system of teaching granting degree "Bachelor of land management" (4 study years), and "Master of land management" (2 study years). Unfortunately, small number of higher education institutions participated

in this experiment. Since 1992 the number of specialties has been expanded, there appeared specialties "Land cadastre" and "Urban cadastre", and first generation of National Educational Standards were accepted. These standards were used until 2000.
Second generation of education standards were introduced in 2000. They defined general requirements, structure and conditions of teaching and specified the set of necessary disciplines. Direction of studies "Land management and cadastre", which included three specialities ("Land management", "Land cadastre" and "Urban cadastre") were moved from sector "Agricultural sciences" to sector "Technics and technology". Curricula for second generation of education standards could include so-called "regional component" - universities could introduce specific regional disciplines.
Implementation of Bologna Process into higher education of Russia also had an impact on preparation of specialists in field of land management and cadastre. On September 1, 2009 bachelor's program was introduced in all higher education institutions in Russia with subsequent specialization on Master level. Gradually old system of teaching was reduced, and now modern legislation and National Educational Standards fully are based on two-level system "bachelor degree – Master degree". The legislation considers bachelor degree and Master degree as independent educational levels of higher education with separate educational standards and independent final certification. Licensing and state accreditation of higher education institutions in respect to bachelor and Master programs are also carried out separately.
In 2011 new, third-generation educational standards, based on competence approach, was implemented, which gave greater academic freedom to universities to include study disciplines in the curriculum. Direction of teaching was named "Land management and cadastre".
In 2015 this direction was included in the enlarged group of specialties and directions of teaching "21.00.00 Applied geology, mining industry, oil and gas industry and geodesy", which is referred to the field of education "Engineering, technology and technical sciences". In 2015 EMC on education in the field of land management and cadastre, created at the State University of Land Management already in 1987, was included into National EMC "21.00.00 Applied geology, mining industry, oil and gas industry and geodesy". EMC participates in development of National educational standards for higher education, exemplary basic educational programs, Curricula, methodological literature, as well as in international European educational projects. Annual meetings of representatives of universities and National competitions for best qualification work of graduates in more than 10 categories take place.
At present decisions of EMC has only recommendatory status, therefore the difference in content of curricula in study direction "Land management and cadastre" is increasing. In such situation the academic mobility of students practically is unattainable, because cross-comparison of disciplines is impossible due to name (title) of discipline rather than volume of credits. In higher education of Russia yet it has not been possible to create conditions for students to form their own educational trajectories, because there is lack of disciplines by choice.
Academic mobility both for students and teachers is a problem due to low level of income. In addition, poor knowledge of foreign languages, especially English, of teachers and students is barrier for mobility. It should be noted that there is a very low awareness among university teachers about basic principles of Bologna Process. Many of them it understands only as replacement of five-year studies with bachelor's and master's degree, and they have rather negative attitude to these reforms (Ким, 2017).
In order to comply with legal norms in the field of higher education, all as well as to control the quality of education in higher education, Ministry of Higher Education and Science of Russian Federation conducts control and supervision activities. At present in the field of education the regulation includes:

- licensing, including control over licensing process;
- accreditation process;
- control (supervision).

Accreditation of educational activities in accordance with Federal Law "On education in the Russian Federation" is divided into state, public, professional and international accreditation. At present state accreditation takes the form of on-site and documentary inspections, but in 2020 new model of state control is proposed to be implemented (Федеральный закон…, 2012).
Important stage in the process of reforming the Russian education system is the transition to new generation of educational standards as close as possible to national professional standards in terms of functions and competencies necessary on labour market. In order to maintain the compliance of educational standards with modern requirements of the labour market, they should be regularly updated.

It is planned to update in 2020 the educational standards of third generation (FGOS 3++). Forming the new standards, there are three types of competences – comprehensive cultural competences, comprehensive professional competences and comprehensive professional competences. Comprehensive (universal) cultural competences are the single set of competencies for bachelor's or master's degree level of education, which is regulated by Ministry of Higher Education and Science of the Russian Federation. Comprehensive professional (sector) competences are established by federal Educational and methodical association and are unified for enlarged groups and areas of training and specialities. Comprehensive professional competences are formed on the basis of professional standards. Educational standard allows introduce additional competencies that provide specific targeted professional activities and functions defined by customer (enterprises and companies) requirements.
New standards will contain:

- clearly elaborated system of internal evaluation of education quality;
- possibility to evaluate education process (conditions, content and quality, etc.) by students;
- involvement of employers and their associations in regular evaluation of the quality of educational activities;
- external evaluation of educational activities on voluntary basis.

Academic freedom in universities remains as problematic issue. Universities have the right to establish the so-called "profiles" in the educational programme. For bachelor program in "Land management and cadastre" such profiles are digital land management, real property cadastre, real property management, agricultural land monitoring, real property valuation, assessment and management of urban areas, legal, geodetic and informational support for land management and cadastre, and others.
The process of implementation of educational program network, which will allow for students to choose individual training courses, disciplines (modules), practices in other educational and scientific organizations, is going on.

Conclusions and proposals

At present in Russia the reform of higher education system, including engineering specialities, continues. This process is part of modernization of higher education, which started after signing of Bologna Declaration in 2003. Bologna Process is aimed to create the pan-European education space, it represents the most significant structural reform of higher education in its history.
The results of implemented reforms have been assessed ambiguously and there are both positive and negative consequences. As positive can be mentioned:

- integration of Russian education system into educational space of the world and mutual recognition of education documents;
- increase in academic and student mobility;
- unification of competence assessment according pan-European systems (credit rating, etc.);
- increase in competitiveness of Russian higher education institutions;
- expansion of participation in international scientific competitions and grants, forums and exhibitions, in international organizations and associations;
- increase in participation in international competitions, forums and exhibitions;
- increase in scientific and publishing activity within international citation systems Web of Science and Scopus;
- dissemination of knowledge and technologies, registration and implementation of the results of intellectual activity at the international level.

As negative consequences can be mentioned:

- increased bureaucratization of educational process;
- complicate system of credit points (ECTS) and complexity of its implementation;
- duplication of quality control functions at various levels;
- absence of ideas about the basic principles, goals and objectives of Bologna process leads to formal attitude to the changes taking place and to the general non-acceptance of the reforms.

There can be made general conclusions as follows:
1. Existing system of education of land surveyors in Russia has long history, currently is developing very actively. The number of universities training bachelors and masters in the field of land surveying and cadastre is increasing in spite of general decrease of total number of universities.

2. Within framework of Bologna Process two-level system for training of land surveyors was introduced in higher education in Russia - bachelor program (4 years) and Master program (2 years). At the same time employers prefer to employ graduates with Master diploma and engineers – land surveyors, bachelors are considered in case if they have practical experience and recommendations.
3. Possibility to change direction of training at enrollment in Master program leads to heterogeneity of levels of knowledge among students. It affects negatively the efficiency of educational process and requires the teacher to make additional efforts in the context of limited classroom hours.
4. Accreditation of higher education institutions is the mechanism how to control compliance with legislative requirements and the quality of training of students at higher education institutions.

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LAND USE PLANNING AS TOOL FOR SUSTAINABLE DEVELOPMENT

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Abstract
The purpose of the article is to evaluate role of land use planning project (hereinafter - LUPP) specified in the legislation of Latvia in sustainable development of territory. In Land Use Planning Law adopted in 2006, LUPP is project for arrangement of territory and measures of improvement of land use conditions, for part of an administrative territory of local government, separate immovable property or land parcel, which is developed for exchange of land parcels or elimination of inter-areas, for reorganisation of land parcel boundaries, as well as for subdivision of land parcels. In Latvia for sustainable development of the territory, legislative acts of spatial development planning system have been adopted at several levels, from which for detailed arrangement of territory detailed plan should be developed. The detailed plan often includes reorganisation of land parcel boundaries, but legislation determines that detailed plan should be developed in territories specified in spatial plan, mainly before commencing new construction. The LUPP is not planning instrument for territory development and may be developed in territories in which regulatory framework do not provide development of detailed plan. However, in local governments it is relatively common that for areas intended, for example, for individual building, for subdivision of land parcels, LUPP rather than detailed plan has been choosen to develop. In order to clarify these concerns, the study carried out survey of specialists of local governments and the article summarises analysis of results about development of LUPP in relevant local governments, as well as, on the basis of relevant regulatory enactments, compared the objectives and conditions for development of LUPP and detailed plan.
Key words: land use planning, land use planning project (LUPP), detailed plan, sustainable development, land consolidation.

Introduction

In order to launch developing idea of area, the area and configuration of the parcel is not always such as needed for planned land use, and it is often necessary to make changes in the boundaries of real property. To perform it legally justified, the legislation of Latvia should provide two instruments for such purposes: development of detailed plan or LUPP oject. The detailed plan should be one of the documents at the local level of the spatial development planning system, which has been established in accordance with the Spatial Development Planning Law adopted in 2011. It is detailed plan of part of local government territory developed in order to lay down the requirements for the use of specific land parcels and building parameters, as well as to adjust the boundaries of land parcels and restrictions (Spatial Development Planning …, 2011). Development of detailed plan, as well as other spatial planning documents, is regulated by the Regulations of Minister Cabinet No 628 "On local government territorial development planning documents", adopted in 14 October 2014 (Noteikumi par pašvaldību…, 2014). Detailed plan should be developed to implement specific development proposal or planning task, detalyzing the requirements specified in the local government spatial plan or local plan.
Legislation provides that detailed plan should be developed:

- in cases specified in spatial plan or locational plan;
- if creation of new land parcels is planned and new streets or municipal roads are needed to ensure access to newly created land parcels;
- if it is intended to construct the road and in the local government spatial plan, in the local plan, in transport development plan or in thematic plan is not resolved access possibilities to one or more land properties;
- before the commencement of new construction, if a redeployment of an existing transport organisation is required, by removing or moving existing streets or municipal roads, or the planning of a new traffic infrastructure by creating new streets or municipal roads, or if the buildings needed to ensure the functioning of the planned site are intended to be placed in several land parcels.

However, development of LUPP in Latvia is determined by the Land Use Planning Law (Land Use Planning Law, 2006). Within the meaning of this Law land use planning is legal, economic and technical

measures for arranging the territory of real property or land parcel for sustainable use of the land resources.

The LUPP should be developed for following land use planning works:

- elimination of inter-areas or exchange of land parcels by reorganisation of land parcel boundaries;
- division of land parcels.

The LUPP should be developed for territories, to which the regulatory enactments in the field of construction, environmental protection, regional and spatial planning policy or the decisions of the city council (board) of local government do not prescribe development of detailed plan. LUPP may be developed as supplement to detailed plan for territory for which there is valid detailed plan or, in accordance with the spatial plan of local government, development of detailed plan is intended, but also the land use planning works should be performed. Taking into account the tasks specified for development of detailed plan and land planning project, it can be concluded that detailed plans should be developed mainly in areas where construction works are provided, but LUPP should be developed in other cases, so the detailed plan is more necessary in cities and in other densely populated areas, while the LUPP – in rural areas. However, after consultation with several Latvian surveying companies, as well as with spatial planners of local governments, it has been clarified that often before new construction not development of detailed plan, but LUPP is initiated in areas where it is necessary to split or reorganize the boundaries of land parcels. The reason for this choice could be differences in procedures for developing detailed plan and LUPP. Although the LUPP is being developed taking into account the spatial plan, regulatory enactments and conditions specified in spatial plan, it is not part of the legal framework of spatial development planning system of Latvia. Consequently, for development of LUPP, legislation does not foresee public discussion, contrary to the procedures for detailed plan, which provides public discussion within three to six weeks, which extends, complicates and also makes more expensive the project process. In addition, mandatory part of the detailed plan, contrary to the LUPP, is development of planned building parameters, layout scheme for traffic infrastructure and engineering communications, and preparation of other information according to the task. The process of developing of LUPP also includes determining of conditions of local government and other institutions for development of the project. These conditions include list of institutions with which the project should be coordinated, but may also include conditions of building-up parameters, traffic infrastructure and engineering scheme and other conditions, if necessary. Accordingly, contractors and local governments, for the purpose of shortening and simplifying process, in cases where, for example, the building of individual residential houses is envisaged at the building site, often choose the development of LUPP rather than detailed plan.

The purpose of this article is to evaluate the role of the LUPP in sustainable development of the territory in Latvia. To achieve this, the following tasks have been identified:

- carry out survey of specialists of local governments about development of LUPP and their importance;
- compare the procedures and conditions for development of LUPP and detailed plan in accordance with regulatory documents adopted in Latvia;
- on the basis of these two studies to assess the role of LUPP in sustainable development of administrative territories of Latvia.

Methodology of research and materials

The object of the study is LUPP as legal, economic and technical measures for arranging the territory of an real property or land parcel for sustainable use of land resources. In view of the fact that the Latvian legislation provides two instruments (detailed plan and LUPP) to determine whether LUPP are being developed, the survey was conducted. The survey was organised in order to find out the current situation about development of LUPP, how and for what purposes the LUPP are developed in the various local governments of Latvia. The questionnaire was produced and distributed digitally using the Google.com personal account, in which questionnaire was inserted electronically with number of questions concerning the development of LUPP in the local governments. Survey questions in the questionnaire were created in standardised way, offering the option of selecting one or more response options. Questionnaires were sent out to all 119 of Latvia local governments. Local government specialists were chosen as respondents because local governments are the first that confront with land boundary relocations. And also, the local government is the one that takes decision to initiate or reject the project.

The questionnaires were completed and returned by nearly half - 50 (42%) of Latvia local government specialists, but questionnaires about joint ownership distribution, which was sent out separately from the questionnaire, even 55 or 46%. The ranks of the survey participants in municipalities were mainly specialists in real property or land affairs, as well as land use planners. In order to assess the needs and differences of the LUPP and detailed Plan as instruments for development of territory, the study on the basis of relevant regulatory acts, analysed and compared the procedural progress and conditions for development of these two projects.

Discussions and results

Adoption of the Land Use Planning Law on the 14 September of 2006 may be considered as the beginning of development of LUPP in Latvia in accordance with the current procedures. Until then, the division of land parcels could be legally justified only through decision of the local government or through a detailed plan.

In order to find out how popular LUPP is as an instrument for reorganisation of land parcel boundaries, specialists of local government in response to the question "How many LUPP have been developed in your municipality since adoption of Land Planning Law, had to choose one of the options: up to 10; 11 - 30; 31 -100; more than 100. Of the 50 respondents 25 or 50%, the last option choosed, while 18 or 36% choosed for 31-100. Only two respondents indicated that less than 10 projects were developed in their municipalities, but it should be noted that these are Alsunga and Lubana novads, smallest territories in Latvia and they are located on remote part of country (Table 1). Consequently, it can be concluded that development of LUPP is relatively popular today, because without LUPP land parcel cannot be divided into two or more separate plots, which are essentially the basis for formation and further development of new real property. Land Use Planning Law adopted in the 2014 identified seven cases when LUPP have to be developed, but after number of amendments, only two cases left listed above. In response to the question "For which purposes LUPP have been developed in your local government", respondents were able to choose more than one answer. However, as the most common purpose for development of LUPP, which was indicated by all respondents, is division of land parcels, and number of 35 respondents (70%), also indicated the reorganisation of land parcel boundaries. Only 30% of all respondents pointed elimination of inter-areas (Table 1).

As result of land reform, when landowners received former land properties, two or more persons often become as landowners and joint property has been created. Joint property right is not comfortable for co-owners, because when co-owners want to do any business, they need consent of the other co-owners. Otherwise it is not possible to deal with their property. However, each co-owner may at any time initiate division of joint property into real shares and it may be done by developing LUPP.

Unfortunately, authors of the article do not have information about amount of joint properties in specific local governments, so in order to discover it, one of the questions in the survey was "How much LUPP have been developed for joint property distribution in local government since 2006". And following options were given - up to 10; 11 - 20; more than 20 projects. The highest number (67%) of respondents mentioned the first response (less than 10 projects), but 18% indicated that more than 20 projects were developed for joint property and 15% of respondents selected option 11 - 20 projects (Table 1). These results of survey indicate that joint property exists as problem in Latvia and their owners are trying to get rid of it.

As mentioned in the introduction, the regulatory framework provides the development of detailed plan before the commencement of new construction, where also reorganisation of land parcel boundaries is planned. However in practice frequently there are cases where LUPP is being developed in populated area where the area is planned for new constuction, particularly for construction of residential houses.

In order to realise extent of this situation, the questionnaire contained the question "Which plan usually is developed in local government for new construction sites?" The most frequent answer to this question was that both detailed plans and LUPP (42%). It depends on complexity of each particular case. Almost equally, these cases usually involve development of LUPP (40%), and only in 18% for new construction sites have been developed detailed plans (Table 1).

Table 1

Survey questions and response variants on development of land use planning projects (LUPP) in local governments

No.	Survey questions and answers	Answers	
		number	%
1.	Number of LUPP developed in your government since adoption of Land Use Planning Law:		
	up to 10	2	4
	11 - 30	5	10
	31 - 100	18	36
	more than 100	25	50
2.	For which purposes LUPP have been developed in your local government? (more than one answer is possible)		
	for division of land parcels	50	100
	for reorganisation of land parcel boundaries	35	70
	for elimination of inter-areas	15	30
3.	Number of LUPP developed for joint property distribution:		
	up to 10	37	67
	11 to 20	8	15
	more than 20	10	18
4.	What is usually developed in the local government for sites for new construction?		
	LUPP	20	40
	detailed plans	9	18
	both LUPP and detailed plans	21	42
5.	How does the local government deals with access to planned land parcels? (more than one answer is possible)		
	using existing municipal roads	31	62
	construction of new roads and streets	13	26
	by servitude or bya designed servitude after establishing the servitude	28	56

Source: Created by authors on the basis of results of survey

Development of detailed plan differs from LUPP with public discussion, as well as specification of planned land use (functional zoning) and conditions for use and building of the site, including provision of engineering equipment, etc. On the other hand, as mentioned above, it is also possible to define these requirements as specific conditions of the local government for development of LUPP. Consequently, local governments, when taking decisions on development of detailed plan or LUPP, are apparently guided by the complexity of each particular case.

One of important conditions for developing LUPP or detailed plan and for creating new land parcels is to establish access opportunities to each new land parcel, as well as access to publicly exploited areas (Vispārīgie teritorijas plānošanas..., 2013; Zemes ierīcības projekta..., 2016). The survey therefore included the question "How local government deals with access to planned land parcels in the projects?" There could be number of answers to this issue and, as shown in Table 1, the most frequent is - using access from local government roads and streets (62%), relatively few (26%) by arrangement of new roads or streets. However, relatively often (56%) in LUPP access to new land parcel is ensured by servitude right or by planned servitude after its establishing.

As can be seen from results of survey, local governments often accept development of LUPP, also in cases where new construction is planned in the developing area and the regulatory framework determines the development of detailed plan. Therefore, in order to assess the importance of these two projects for sustainable development of territory and their differences, comparison of their development processes and conditions was made on the basis of an assessment of laws and regulations (Tabl. 2).

Table 2

Comparison of objectives and conditions for development of land use planning projects (LUPP) and detailed plans

No	Project development indicators and conditions	Land use planning project (LUPP)	Detailed plan
1.	Purpose of Project/ Plan development	Division of land parcels, exchange of land parcels, elimination of inter-areas	Implementation of specific development proposal or planning task, detalyzing the requirements specified in the spatial plan or local plan
2.	Does the development of the project/plan always involve changes in the boundaries of land parcels?	Yes, with changes in boundaries of land parcel	Common, but not always
3.	Should the project/plan developer be certified person?	Works shall be performed by certified persons	Not always, but, if division of land parcels or exchange of land parcels or development of minimum composition of building project is planned, it should be performed by certified person
4.	Graphic base for the graphic part of the project/plan	Should be fomed on cartographic materials in various scales (1:10000, 1:2000, 1:50 000), reciprocally incorporated with a land-boundary plan	On the basis of a valid high-detailed topographic information topographical plan, using current information about land parcel in the Cadastre Information System
5.	Public involvement and participation in project/planning solutions and openness	The developed project should be co-ordinated with initiator and owners of land parcels included in the project territory	Draft of detailed plan should be released for public consultation and receipt of the opinions of the institutions
6.	Approval of project/plan	The local government should approve LUPP, issuing an administrative act	The local government should approve detailed plan, issuing an administrative act, entering into force after notification
7.	Validity of project/plan	LUPP should be implemented within four years after its approval.	The time period has not been specified, but the local government may prescribe a time period within which the implementation of the detailed plan has to be commenced.
8.	Conditions for implementation of the project/plan	LUPP has been implemented if the project territory has been cadastrally measured, registered in Cadastre Information System and in the Land Register	Detailed plan has been implemented if territory of detailed plan has been used in conformity with the solution of the detailed plan and the specified requirements.

Source: drawn up by authors on the basis of the regulatory enactments in the development planning of the territory of the Republic of Latvia and land use planning (Noteikumi par pašvaldību..., 2014; Zemes ierīcības projekta..., 2016)

When analysing the purposes for development of LUPP and detailed plan, it may be established that each of documents has its own purpose. LUPP should be developed for division of land parcels or for redeployment of boundaries, so that after implementation of project transactions with real property can be carried out - to sell a part or all of the former land property or to split the land in real parts of the joint property between co-owners. On the other hand, the purpose of development of detailed plan is an implementation of specific spatial development or planning task and detalizing the land use and building conditions specified in spatial plan. Development of detailed plans often is also linked to division of land parcels or redeployment of boundaries, but changes in land parcels are more of subordinate nature and not necessary in all cases of development of detailed plan (Table 2).

Developers of LUPP should have the certificate for land use planning works. But within development of detailed plan, if division of land parcel or development of minimum composition of building project is planned, it should be performed by certified person. On the other hand, in accordance with the Law, development of detailed plan may be combined with construction project, and in such case the developer of detailed plan should have certificate in construction, too (Table 2).

Taking into account the fact that detailed plan is designed for concretisation of land use specified in spatial plan, the graphical part of plan should be performed on the basis of highly-detailed topography plan, as it should show in detail all encumbrances, detailed conditions for use of the site, building and other parametres. However, for development of graphical part of LUPP, depending on tasks and situation of project, regulatory framework allows for great variety: topographic map in scale of 1:10000 or topographical plan in scale of 1:2000; a plan with highly-detailed topographic information; an orthophoto map in scale of 1:10 000, 1:50 00 or 1: 2000; situation or encumbrance plans, etc. (Table 2).

In order to ensure public awareness and participation in the spatial development planning process, mandatory requirement for development of planning documents at all levels is to release the draft of plan for public consultation. Process of developing detailed plan should specify the need for public consultation, setting a time limit of not less than three and not longer than six weeks. On other hand, the regulatory framework for development of LUPP does not provide for this public consultation, except for individual cases where co-ordination with other land owner, not included in the project, is required, if it is specified in the conditions of project development.

In view of the fact that development of these two projects is related to land use, which may be burdened with protection zones of different objects or otherwise limited, co-ordination of projects with institutions specified by government or by laws is intended in both cases (Table 2). Completion of these two projects have to be approved by local government in the same way - with adoption of administrative act, but the follow-up is different.

The term specified in Law for implementation of LUPP is 4 years during which the project area must be cadastrally measured, registered in Cadastre Information System and entered in Land Register. If these works have not been performed within 4 years, the developed LUPP should cease to be valid. However for detailed plan the time period has not been specified, but local government may prescribe time period within which implementation of detailed plan has to be commenced. If implementation of detailed plan has not been commenced within specified time period and has not been extended within one year after the expiry of this period, the detailed plan should cease to be valid. In addition, realisation of changes of land larcel boundaries in detailed plan should not be considered as implementation of the detailed plan, which is the result of implementation of LUPP (Table 2).

In administrative agreement regarding implementation of detailed plan, local government and detailed plan implementing body should agree about conditions upon which division of land parcels may be commenced: these are issues about construction, ownership and entry into service of roads and streets, engineering euipment, improvement, and other issues as well.

As result of analysis, it can be concluded that land use planning system in Latvia allows choice of an instruments (detailed plan or LUPP) in each particular case of spatial arrangements related to division of land parcels and rearrangement of boundaries.

However, often in cases of planned buildings, where the situation is not complicated, spatial developers prefer LUPP rather than detailed plan, since development of LUPP is simpler and shorter, and their regulatory framework also allows setting of specific conditions (for engineering and other development work) related to planned development territory. And, although LUPP is not included in spatial development planning system in Latvia, in practice it is legally applied in cases of division of land parcels or boundary relocations, which is the first step towards sustainable development of the territory.

Looking at experience in land use and sustainable development, it can be found that countries such as Germany, Denmark, the Netherlands, also Scandinavian countries are dealing more systematically with sustainable development issues of territory, particularly in rural areas. Land use planning activities in these countries usually take part as basis for further development of territory. In Western Europe rural development and redeployment of territories are carried out through land consolidation. In addition, these land consolidation projects are very diverse: from simplified land-parcel distribution and boundary redeployment to large-scale sustainable development solutions that play an economic, environmental and social role (The Design of Land Consolidation…, 2003; Kummer & Frankenberger, 2012; Elvestada & Skya, 2019).

Also in Latvia adoption of Land Management Law defines set of land consolitation measures within scope of which complex rearranging of land boundaries have to be carried out in order to form rational structure of holdings and area of land parcels, to promote development of rural infrastructure and rural development, as well as environmental protection (Land Management Law, 2014). Although this law already has been in force for five years in Latvia, nevertheless there is not developed and adopted land consolidation methodology. Any land consolidation projects have been developed.

In fact, LUPP and detailed plans as tool for sustainable development are sufficient to carry out larger and smaller land rearrangement measures in Latvia.

As this study showed, this is also demonstrated by practice in local governments. In addition, LUPP have an important role there. LUPP, in substance, are also land consolidation projects, as their aim and objectives are the same. The Land Use Planning Law adopted by the Republic of Latvia in 2006 and the Cabinet regulations issued in accordance with it in current version (Zemes ierīcības projekta…, 2016) do not comply with all requirements for land arrangement and area development. Although in the Land Use Planning Law defines land use planning as set of legal, technical and economic measures, in fact the LUPP deals only with legal and technical issues. In practice in development of LUPP is not observed economic issues and rational land use. For example, development of LUPP for needs of major State infrastructure facilities is very inefficient. Separate LUPP should be developed for each land transfer (from each land property) to alienate land for the construction of roads or railways in Latvia. This is also due to current rules for development of LUPP, which are more focused on division of land parcels. Very often there are small plots of inter-areas that are not currently being addressed. In other countries in such cases, complex land consolidation projects are developed, covering larger part of administrative area, which separates land for infrastructure purposes and sorts land parcels around these sites. Unfortunately, LUPP in Latvia are mainly regarded as an instrument only for division of land parcels. It would be desirable that land use planning would be part of spatial development planning system with greater power for the redeployment of territories, including land consolidation.

Conclusions and proposals

1. In order to modify area and boundaries of real property, there are two legally regulated instruments in Latvia: detailed plan, which is local level document of spatial development planning system, and LUPP that does not belong to this system. However, objectives and conditions of implementation of these two documents are different.
2. Although legislation of Latvia has relatively strict definition of cases and territories for development of LUPP and detailed plan, clients often choose simpliest method - development of LUPP instead of detailed plan. It is possible with applying of special conditions system. In such cases, however, an assessment of public attitudes may occasionally be omitted.
3. LUPP in Latvia is not included in spatial development planning system, but in practice it is applied in cases of division of land parcels. Therefore, it becomes as basis for sustainable development of territory.
4. Current legal framework and methodology of LUPP in Latvia do not correspond to wider reorganisation of land parcel boundaries and implementation of land consolidation. Need for reorganisation of land parcel boundaries, particularly in rural areas, in future will increase. Therefore legal framework for development of LUPP should be improved.

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CURRENT TRENDS AND TASKS OF TRAINING OF LAND MANAGEMENT SPECIALISTS

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Abstract
In 2015-2016 the State University of Land Use Planning and land management faculties of higher educational institutions released the final mass enrollment of graduates who studied “engineer” qualification for five years.
Starting from 2016-2017, bachelors and masters of land management began to leave the walls of the State University of Land Use Planning and land management departments of universities. Has the division into two parts - bachelor's and master's been justified? Basically, we can say that this is an international practice and we would not want to live separately from the international community, since we study foreigners from many countries of the world who want to receive education in a Western way; in addition, our students also study abroad.
But, unlike the Western baccalaureate, we remain specializations. There are profiles in the undergraduate program: land administration, land management, real estate cadastre, urban cadastre, land valuation, real estate valuation, and so on, that is students receive professional knowledge.
Mastership is designed to deepen them. But it is absolutely not necessary to choose undergraduate and graduate programs in the same direction, it can be changed. If a student is not satisfied with the direction or specialization chosen before, he can correct it by studying another mastership program.
One undoubted positive consequence of Russia's accession to the Bologna process is the simultaneous assumption of international obligations to maintain the wide accessibility of higher education regardless of financial situation of young people. Europe seeks to provide broad social protection in this area, where Russia has been catastrophically losing ground in recent years. The United States, with all its wealth, has never tried to positively solve this problem and is not going to accept the Bologna rules, and they have enough compelling arguments for this.
First of all, do we need a bachelor degree? How will a master match with a candidate of science? Today, the heads of land surveying firms and companies, sociologists, professors of universities as well as educational and scientific institutions are discussing this problem.
Keywords: education, digital economy, land use, land management, scientific and technological development.

Introduction

The main theme of the economic development of the Russian Federation in recent years has been the implementation of the national program “Digital Economy of the Russian Federation”. Using digital information and communication technologies, the currently established economic, social, and cultural relations between economic entities and consumers of products manufactured by the country's economy, citizens and structures of various forms of ownership providing various services are changing. In our opinion, digitalization contributes to the effective development of individual enterprises, as well as entire industries, and, as a result, to the economy as a whole (Волков и др., 2019).
The president of the Russian Federation V.V. Putin at the meeting of the Council for Strategic Development and Priority Projects on July 5, 2017, dedicated to the digital economy of the Russian Federation, noted that “The digital economy is not a separate industry - in fact, it is a way of life, a new basis for the development of public administration, economy, business, social sphere and the whole society. The formation of digital economy is a matter of national security and independence of Russia; it touches on competition of domestic companies, the country's position on the world stage for the long term, in fact, for decades!” (Путин, 2017) Everywhere in the world, the use of digital technologies is reflected in the development of all sectors of the economy, including agriculture.
So, the digital transformation of the agricultural sector is inevitable. For the optimisation of the country's economy, the most important area of activity of the agro-industrial complex of Russia is the training and retraining of personnel to demanded digital competencies (Стенограмма заседания Совета..., 2016, Стенограмма заседания Совета..., 2016).
Higher land use planning education in Russia is over 180 years. At the beginning of the 20th century, the term "land use planning" began to be used in many spheres of public life and, first of all, in economics, politics, education and science. The words "surveyor", "surveying engineer" began to be replaced by the words "land engineer", and a little later - "land use planning engineer", because these

experts knew not only the technical and legal, but also the economic, organizational, economic and environmental aspects of land management.
The simplest task in the preparation of engineering and land management personnel was to develop four features in a student: actual knowledge; the mastery; his own point of view and a constant desire for continuing education. If a student understood that he needed these features as a future land use planning engineer, then the effectiveness of training increased significantly.
The future land use planning engineer of those days was studied a wide range of the fundamental sciences, engineering and geodetic technologies. He also studied the basics of agricultural and land policy; organization and production management; jurisprudence; drawing up and signing maps and plans; calligraphy; architecture; geography; statistics; building art; agricultural and forest taxation; soil science; agriculture; understood organization of roads and hydraulic structures, labor relations; psychology and sociology. In addition, He knew the economy well in order to understand the issues of rationing, planning, cost, pricing, working capital, depreciation and other economic categories (Волков, Косинский, 2018).
Applying the acquired knowledge, the land use planning engineer also used his mathematical abilities, drawing and painting. To find the optimal solution to his task, the land use planning engineer, based on his experience and qualifications, could use modeling and mathematical analysis. During experimental work, an engineer, as a rule, set the task in such a way as to obtain the maximum of reliable information with a minimum of time and cost. The accuracy and value of his conclusions based on the results of observations depended on the skill of the engineer in experimenting and conducting measurements.
An engineering point of view is a property that cannot be attributed to either knowledge or experience. The constant and deep interest in his profession, the desire to find out and clarify all the necessary details is one of the components of the engineering point of view. Also very important aspects of profession are objectivity and professional ethics. Another important feature is the willingness to innovation. In this regard, practicing land use planning specialists – teachers in universities always brought new things to the educational process, including modern tools and the latest technologies.
One of the main tasks of engineering education was the development of logical thinking methods among students, the encouragement of the desire to understand everything, the development of the ability to think clearly, and a critical approach to the existing methods – the characteristic of the inventor. Another skill of an engineer, the importance of which is difficult to exaggerate, is the ability to work with people of various professions in order to ensure maximum efficiency of his work. That's how land use planning engineers successfully trained for many decades in the system of Soviet and Russian education.
The state has to decide what kind of specialists it needs today and how many! And what is the end result that we should focus on?!

Methodology of research and materials

The aim of the article is to evaluate the main criteria for training of land management specialists in Russia in the new conditions of digital economy. In order to achieve the goal, the significance and necessity of the main aspects of bachelor's and master's study programs nowadays have been assessed.

Discussions and results

Bachelor degree, in our opinion, should form the basic professional competencies of students and prepare ordinary but skilled employees performing executive functions. Now at least 80% of bachelor's graduates continue education in magistracy (this is a common practice for those countries that just have switched to the Bologna system). In the future, this share is usually reduced to 20%., and instead of master's programs, various advanced training courses are often used.
Magistracy, in our opinion, should prepare specialists capable of solving the most complex, creative problems not only in practical, but also in analytical and research spheres. The magistracy programs should contribute to the further development and promotion of the employee in in-depth and advanced specialization, or in the scientific or managerial spheres. In fact, master's degree is an analogue of the second higher education, or in some cases - an analogue of graduate school.
Many people express concerns that the bachelor's training program is simplified and such an employee cannot cope with his functions, since he is trained one year less than a classical engineer. But, according to the plan of the Ministry of Education and Science of the Russian Federation, the development of the young generation will be carried out not only and not so much through academic disciplines, but through integration into the scientific, industrial and cultural environment of the university.

However, difficulties with employment stimulate young people to look for an employer as early as possible, almost from the first year of study at a university. There is no country in the world where it is encouraged. Only our legislation provides that if a student is successfully studying, he can work. Using this, students go to work when they need to study. Part-time work is good on vacation, but not during school hours! Otherwise, the student leaves the university with working experience, but with a low quality of knowledge. A university is not only classroom studies, it is communication, science clubs, conferences, discussions, internships abroad, etc. A very important function of the educational process is the acquisition of friends.

The future work teams, the partners are formed within the walls of the university. And if you spent two or four hours at the lectures and fled to work, much of this was lost. Of course, not only students, but also employers are to blame. They require working experience, forgetting that knowledge, skills, competencies is more important. Experience can be acquired during practice, but knowledge is something more difficult.

In land management, the problem with personnel has been extremely acute for over 25 years. That's because of the numerous transformations (from 1991 to 2016 the country's land management authorities were reformed 15 times!) gradually blurred the land management functions and the functions of qualified land use planning personnel. As a result, the value of professionals having a degree and the level of respect for them have been reduced. Business did not and does not make a request to universities: who they need, when and for what tasks. Due to the ongoing trend, the situation in land management remains difficult. Personnel are being changed by so-called "effective managers" who, without knowledge of professional nuances, the essence, goals, objectives and contents of the land management system, ultimately destroy its main tool and the organization of rational land tenure and land use - land management.

The existing success of world scientific and technological leaders are largely determined by the effective integration of science, education and business, which is an effective tool for improving the quality of education and labor, sustainable development and competitiveness of specialists, enterprises, countries and their regions. National land services operate effectively in Sweden, Norway, Finland, Australia, China, the USA, Germany, the Netherlands and other countries, and land management occupies the most important and worthy place in their institutional infrastructure.

In the national economy of our country, we need an investment model with greater competition, without flaws in the business climate and the "dominance" of power structures (Буров, 2011; Буров, Чистяков, 2016). In the formation of a culture of knowledge-based production, education plays an important role, because in modern high-tech production, the more skilled a worker is, the higher his general culture and the quality of his work. The preparation of high-quality workers is one of the fundamental principles of the life of any country.

It must be admitted that the system of higher and secondary special education, and also the personnel retraining system in land management, which developed under the conditions of directive planning and a high degree of population employment, is still slowly rebuilt for new requirements. Educational institutions respond weakly to bringing the educational structure, volumes, programs, profiles, qualifications of training personnel to the requirements of a market economy. The quality of training for a part of graduates of educational institutions does not meet the modern requirements, since sometimes there is no balance in fundamental knowledge and special disciplines. Our task today is introduction mathematics and information technology into curricula, and provision fundamental knowledge at the intersection of economics and information technology, economics and mathematics.

Special studies conducted in the Lipetsk region showed that the most optimal ratio of students in institutions of higher, secondary and primary vocational education is 100: 120: 200, that is, for every 100 graduates with higher education, 320 graduates with primary and secondary vocational education should be prepared (Буров, 2011).

In the 60s, American economists justified the concept of "half-life of skills," i.e. the period during which the knowledge of a university graduate becomes obsolete and the employee becomes unsuitable for further work. It has been established that after graduating from a higher or secondary specialized educational institution, a former student annually loses about 20% of knowledge (Административно-управленческий портал, 2020).

In most developed countries, a network of research and testing centers has been formed for the collective use of scientific and testing equipment of various profiles, expensive facilities and complexes. The Centers for Collective Use of Scientific Equipment (CCU) are created, as a rule, in the form of public-private partnership. In Russia, the CCU creation is supported by the Ministry of Education and Science

of the Russian Federation as a part of the federal state scientific and technical program “Research and Development in Priority Directions for the Development of Science and Technology for Civil Use” (Образование и общество..., 2007; Административно-управленческий портал, 2020). Financing of created CCU can be provided at the expense of the regional budget, funds of the Ministry of Education and Science of the Russian Federation, corresponding ministries and departments of the Russian Federation and extrabudgetary sources (such as manufacturers of equipment, materials, structures, investors, research organizations, self-regulatory organizations, etc.). The role of the teachers and students of universities is invaluable here.

For the economy development it is also necessary to create centers of competence, which should provide intellectual, personnel support for projects related to the formation of new markets and new industries. The activities of such centers should be closely integrated with the education system, the economy, high-tech firms and companies.

At present, Russia is in the fifth place in the world in terms of budget financing of the scientific sphere, but the share of extrabudgetary funding remains low (Стенограмма заседания Совета..., 2016).

Unfortunately, participants in the land management business recall the existence of land management science when force majeure circumstances or controversial, unresolved issues arise, or, for examples, when it is necessary to conduct an examination of design estimates. As a rule, even reputable firms spend only hundredths of percent of their revenue on research and development. Although in foreign countries, for example, in India, private investors spend half of the funds in scientific innovations. So, here is also a wide range of creativity for researchers, teachers and students.

However, at present, only 10% of all state educational and scientific organizations make a significant contribution to world and domestic science (Стенограмма заседания Совета..., 2016).

Currently, the Federal Center for Research in Land Use, Land Management, Soil Science and Cadastral Activities is urgently needed. It should determine and maintain priorities in various areas of scientific research, pre-project support for the development of the country and its regions, the development of the Russian space, the justification and construction of a new model of economic relations, including land relations, coordinate their financing, preserve scientific personnel and attract young researchers.

Unfortunately, for the vast majority of tutors researching activity is losing its attractiveness: the share of university professors participating in research has decreased from 38 to 16%, or even less. About 80% of higher education programs are not based on scientific works. As a result, the overwhelming part of it turned into “college-level training, where they teach according to the best textbooks and rather reproduce knowledge than develop it” (Образование и общество...2007). The continuation of this trend may have irreversible consequences not only for education and science, but also for the prospects for state management of the socio-economic development of the Russian economy and its regions. It should be noted that the forms and mechanisms of integration of science, education and business in Russia don’t have regulatory legal support, and even situated outside the existing legal framework. The Ministry of Education and Science of the Russian Federation has been attempting to rectify this situation, but so far these actions have not brought the expected result.

Integration as an organizational and economic process means, first of all, combining the resources of scientific and educational complexes, including their innovative potentials, and obtaining socio-economic and commercial effects. It is supposed that the state will stimulate the development of simple and more advanced forms of integration, such as innovative consortia that unite universities, technical schools, colleges, scientific organizations, enterprises and, possibly, financial institutions, with the subsequent formation of sustainable innovation clusters.

An effective integration of education, science and industry will undoubtedly lead to an increase in the innovative potential of the Russian economy.

For example, the introduction of energy-saving technologies (and use of alternative energy sources) is a political program. It is necessary that the whole society understood the need to minimize the human impact on the environment. There are many modern alternatives - solar collectors (the basic element of energy-water storage), heat pipes (Levalle vacuum pipes), decreasing of air conditioning and increasing of energy recovery, heat recovery from effluents, the creation of dirt trap systems, creation of stainless steel effluents system, as well as creation of clean streets system as in Scotland where overhang take place along the passerby part of the streets. In this work, there should be a study and examination of the key problems of living arrangements; we need to support the implementation of original interdisciplinary projects of international and interregional significance. We also need new scientific research for the educational process. Universities should be more fruitful in science, create their own

scientific schools, and attract students (Дмитриев, Межевич, 1982; Мухаметзянов, Гусев, Разяпов, 2015).

Integration processes can be developed in certain organizational forms: technological centers, universities, research and production associations, special economic zones, consulting firms, etc. We underline that it is necessary to create technological centers for small and medium businesses not only for rent and making money – instead of that, technological centers have to be the places where small enterprises can create and introduce new technologies under the leadership of interregional public structures.

Neither the Ministry of Education and Science of the Russian Federation, nor the regional departments of education and science, nor the heads of educational institutions can how to train and retrain specialists for an innovative economy and, as a result, the authority to strategic and tactical management of integration processes are in the hands of organizations with financial capabilities. These issues were discussed at the meetings of the Presidential Council on Science and Education in January and November of 2016. V.V. Putin emphasized that educational organizations must comply with the priorities of the country's scientific and technological development and "it is necessary to look beyond the horizon of one, or maybe even two decades, to analyze what competencies will be in demand in 10 or more years, and which specialists need to be trained today" (Стенограмма заседания Совета..., 2016, Стенограмма заседания Совета..., 2016).

Speaking about the economic conditions of integration, we think that negative socio-economic phenomena had and have a destabilizing effect on the development of science, education and business. Social and economic instability, sanctions, financial deficit, aging and inadequacy of the material and technical base to the modern needs of scientific and educational activities, reduction of young personnel and scientific and pedagogical workers due to low salary, economic weakness of organizations at the stage of involvement in market relations, lack of information – all these factors slow down our country. In market relations, the search for fundamentally new integration models is very important, the significant economic condition is the diversification of sources of financing for research and educational technologies (i.e. grants, contracts with business entities, the implementation of scientific developments, scientific support, consulting, expertise, information services, design, survey, organizational services, implementation of patents, licenses, etc.). A special role here should be played by scientific and technological innovations and creation of financial institutions with the participation of the state for stimulation of commercialization. The problem is that there is no demand for innovation or it remains relatively low. The scale of demand for new developments in comparison with China, India, and Brazil is about 4 times. At the same time, our state spends on innovation more than the UK, China, Japan, but in our technological and innovative zones, our developments are taken by China, Turkey, Hungary, the Czech Republic, but not Russian enterprises.

It is necessary to actively introduce scientific and educational consortia, effective technological centers and complexes on the basis of universities, venture capital funds, technology development funds, and investment funds to promote the development of small businesses in the scientific and technical field. However, the situation can be significantly changed only when the enterprises demand innovations and realize that this is their stability and future.

Unfortunately, the profession of a scientist has still no value in Russia. The 1990s, which were difficult for a national higher education, completely devalued the position of a professor and university teacher. The growth of Russian publications over the past 15 years was only 12%, compared to tenfold in China and threefold in India. At the same time, in terms of the number of articles, China overtook us in 1997, and India in 2005. According to the Institute of Sociology of the Russian Academy of Sciences, the profession of a scientist is prestigious for only 8% of the country's inhabitants (Образование и общество..., 2007; Административно-управленческий портал, 2020). At the same time, in the USA, the profession of a scientist is the most prestigious for 51% of the population, very prestigious for 25% and prestigious for 20%.

At the same time, the requirements for higher and secondary special education are increasing in our country. The business mainly introduces innovations that promise a profit. However, progress is not only new technologies and equipment; it is a revolution in thinking. For example, the knowledge gained on "extreme" compositions can also be applied to traditional ones, while obtaining fundamentally new results including those that bring considerable economic effect. This requires not only the introduction of innovations, but also the solution of such urgent problems as resource and energy efficiency, safety, ecology, long-term development of territories and such a concept as a "smart city" - now all this is synergetic life-planning systems, including land use and land management.

In these conditions, the higher land management school and land management science are forced to change the way they function. Various educational organizations (usually commercial) are offering educational services, which are beyond the state standards, but meet new demands of business and public. We can develop another scheme adopted abroad - the departments of land management companies. This is a convenient form for supporting leading professors and teachers, and restoration of former respect and authority to the "professor" mission. A special role here is played by communication of scientists, teachers and entrepreneurs realized, in most cases, in the form of scientific forums, conferences, seminars, symposia, round tables, etc.

Conclusions and proposals

Nowadays domestic science, education and business in land management are at the stage of searching for effective viable forms of integration. They are built according to the network principle, which equalizes its participants, so different in institutional and organizational specifics. Boards of trustees, national, regional and international associations of networks, international focal points began to appear taking the role of initiator of integration processes, and subsequently, the role of a network manager that regulates the processes of interaction between science, education and business. It is the creation of flexible network structures based on multilateral agreements that unite universities, technical schools, colleges, scientific organizations, enterprises, innovative firms. Their further development can be considered one of the necessary conditions for the successful functioning of integration of scientific and technological complexes in land management. These priorities are also laid down in the Strategy for Scientific and Technological Development of Russia, approved by the President of the Russian Federation in November 2016.

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GOOD PRACTICE OF STATE LAND PLANNING IN THE CASE OF PANEVEZYS CITY MUNICIPALITY

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Summary
Currently, the issues of the use and transfer of state land remain quite relevant in Lithuania. According to the data of January 1, 2019, more than 10 percent of the country's territory has not yet been formed and not authorized for use. A large proportion of unauthorized state land is located in major cities in the country. Only a few municipalities in Lithuania have detailed state land use planning. One of them is Panevėžys City Municipality, where, with the help of EU funds, detailed and special plans have been prepared for almost all state land and the municipality is actively looking for ways to encourage residents to become more actively involved in the process of land ownership or use. Detailed territorial planning documents for this municipality were prepared in three stages. Territories near public buildings, apartment buildings, former problem areas were planned. These plans are important for the development and renovation of engineering infrastructure, urban green spaces, management of residential areas, well-being of the population, and so on. Territorial planning documents are an important tool for the sustainable development of territories. The recent adjustment of the detailed plans is based on the principle of continuity. Effective real property management creates good conditions for investors, improvement of infrastructure and living conditions, replenishment of municipal budget and so on.
Keywords: territorial planning and management, state land

Introduction

Territorial planning documents and their timely implementation are one of the most important factors in land administration and ensuring sustainable development of territories. Master plans are prepared for all Lithuanian municipalities and many cities of the country. These plans require special, detailed or land tenures plans, especially in major cities or their suburbs. Their importance is greater in heavily urbanized or urbanized areas. The territorial planning system and its influence on the sustainable development of territories have been discussed by a number of authors (Aleknavičius, 2012; Juknelienė et al., 2017; Pašakarnis et al., 2016; Štreimikienė et al., 2014; ect.). Territorial planning solutions, effective real property management, and sustainable development are highly dependent on the country's legal regulation (Lietuvos Respublikos..., 1999; 2004; 2013; 2014) and land and other real property administration (Obrazcovas et al., 2003; Raišienė, 2003; Vaitkevičius, Birštonas, 2015; Williamson et al., 2006; ect.). Currently, in the course of land reform in Lithuania, the majority of state land is being transferred to private ownership or given for use. Both land transfer and other land management issues are more complex in urban areas.

This article discusses the issue of state land use, which is of interest to both authorities and the public. In Lithuania at the beginning of 2019, state land accounted for 1/4 of the total land area registered in the Real Property Register. In about 12 percent of the territory of the country land, land parcels are not yet formed and not authorized for ownership and use. Only a few cities in Lithuania (out of 103 cities) have detailed or special plans for almost all state land detailing the use of this land. However, most of these areas are unauthorized and not registered in the public register. Land formation and registration should be accelerated.

Formation of unoccupied state land in the country is initiated and implemented by municipal administrations. They are responsible for the preparation and implementation of territorial planning documents in their territories. In addition, municipal administrations carry out maintenance, protection and inventory of infrastructure, green areas, make proposals for declaring natural objects protected, set urban requirements for land use, issue building permits, maintain roads, protect and manage landscapes, established protected areas, etc. There are still a number of problems to be solved in Lithuania in order to legitimize the use of state land, a significant part of which is also located near apartment buildings as well. One of the first administrations that initiated the preparation of such plans for almost all state land is the Panevėžys City Municipality Administration. At the beginning of the year 2019, more than 1/3 of the state land area was registered in the public register. Panevėžys municipality is one of the leading municipalities in Lithuania compared to other major cities. The article discusses good practice of state land management in Panevėžys City Municipality.

The purpose of this study is to describe the main features of state land planning and management in Panevėžys City Municipality.
The object of the research is the State Land Fund of Panevėžys City Municipality (Panevėžys is the capital of one of the country's ethnographic regions – Aukštaitija. It is located in Northern Lithuania, in the Middle Lowlands, in the valley of the Nevėžis River. The city was extensively developed in the mid to late 20th century).

Methodology of research and materials
Methods of analysis, synthesis and generalization of interviews, territorial planning documents, other sources and statistical data were used for the research.
To evaluate the state land planning and management works in municipality, an interview-conversation plan was prepared and 5 main questions were asked. They are as follows:
1. What funds have been used for territorial planning, management, landscape protection and other projects?
2. How are the areas planned in the neighborhoods of apartment buildings adjacent to residential buildings districts?
3. How do municipalities prepare territorial planning documents, organize and implement territorial planning work related to the formation and administration of unoccupied state land territories, infrastructure objects, greenery maintenance and protection, inventory
4. The response of the municipality to the needs and emerging problems. Perhaps there are areas to be redesigned, for what reasons?
5. Are land formation and redevelopment projects under development? Who should be the organizer of these projects?
Municipal administration specialists who have been working in the Territorial planning and Architecture departments for several years have been selected as experts. The average age of the expert is 49 years and the average work experience is 16.5 years. Territorial planning documents prepared in the municipality and presented on the official website of the municipality, in the e-maps, in the information system of the Territorial planning and Land use planning documents were also analyzed.

Discussions and results
The topic of state land use is relevant both to the authorities and the public. In Lithuania at the beginning of 2019, state land accounted for nearly 25 percent of the total area of land registered in the Real Property Register. In the analyzed Panevėžys District Municipality the state land accounted for more than 1/3 of the total registered area in this municipality (see Table 1).

Table 1

Distribution of Land Fund according to the principle purpose of land use in Panevėžys City Municipality

Main land uses	2014 01 01 thou. ha		Registered in RPR* until 2019 01 01		of which state land	
	total area	of which state land	thou. ha	percent**	thou. ha	percent**
Agriculture land	1.231	0.218	0.961	78.067	0.02	2.08
Forestry land	0.032	0.027	0.005	15.625	0	0
Aquaculture land	0.088	0.088	0	0	0	0
Land for conservation purposes	0.005	0.005	0.002	40.000	0.002	100
Land for other purposes	3.57	2.387	2.541	71.176	1.249	49.15
The fund of unoccupied state land	0.085	0.085	0	0		0
Total	5.010	2.810	3.510	70.060	1.271	36.210

Explanation: * - in the Real Property Register, ** - of the total area of land intended for that purpose as of 01.01.2014, *** - of the total area of that land registered in the Register of 01.01.2019
Source: Statistical summaries of SE Center of Registers

The directions and conditions for the use of the land shall be determined in particular in the territorial planning documents. After the preparation and approval of the Panevėžys City Territory Master Plan (2008), it became necessary for the city to specify the solutions of the Master Plan and to establish regulations for the management and use of the territories. It was decided to create shared public spaces, green spaces, and to balance the interests of natural and legal persons with regard to land use. In order to elaborate the solutions of the Panevėžys City Master Plan, the Panevėžys City Municipality Administration was looking for ways to find out the possibilities of using unoccupied state land and to create a coherent and harmonious urban system of the planned territories. The Panevėžys City Municipality Administration, using the European Union structural funds, has prepared the main territorial planning documents, which are necessary for the proper administration of state land. These territory planning documents were prepared in 3 stages.

During the implementation of Phase I of Panevėžys City Territory Planning Documents, from March of 2009 preparation of "Detailed plans of territories near apartment buildings and unoccupied state land in Panevėžys city" was started. The detailed plan solutions formed about 377 ha of land use of multi-storey residential houses of Panevėžys industrial free-planning construction, dividing the territory into separate parcels of land in such a way as to create preconditions for the development of a full-fledged living environment. Director of Panevėžys City Municipality Administration by Order No. A-177 of March 9, 2012 approved the concept of detailed plan of Territories near multi-storey residential houses and unoccupied state land in Panevėžys, where 19 territories are planned. The planning phase was completed in March of the year 2013. Exactly 4 years passed before the apartment buildings and some unoccupied state land parcels were registered in the Real Property Register. Panevėžys City and a large part of its territory are implementing master plan solutions, because at the moment there are detailed planned territories located in the areas of apartment houses. These solutions include engineering corridor infrastructures, green spaces, parking lots, and boundaries to existing apartment buildings. The boundaries formed around the apartment buildings significantly changed the established order (especially the territorial boundaries of maintenance, cleaning, mowing). The planned urban area is divided into blocks. Owners of apartment buildings and associations carry out cadastral surveys of land parcels at their own expense. Municipal experts commented that cadastral surveys have so far been made on about 20 parcels of land, and the communities of these houses have leases in place. Unfortunately other cadastral surveys of land parcels near apartment buildings are inactive; the reason for this is that there is so far little motivation for communities to validate their land parcels. Land tenure would be calculated when land use is legalized. Municipal administrations are looking for ways to accelerate this process.

In Phase I, in 2013, a special plan for residential areas of Panevėžys City (Patvirtinti specialieji..., 2015) covering eight territories was prepared (Figure 1).

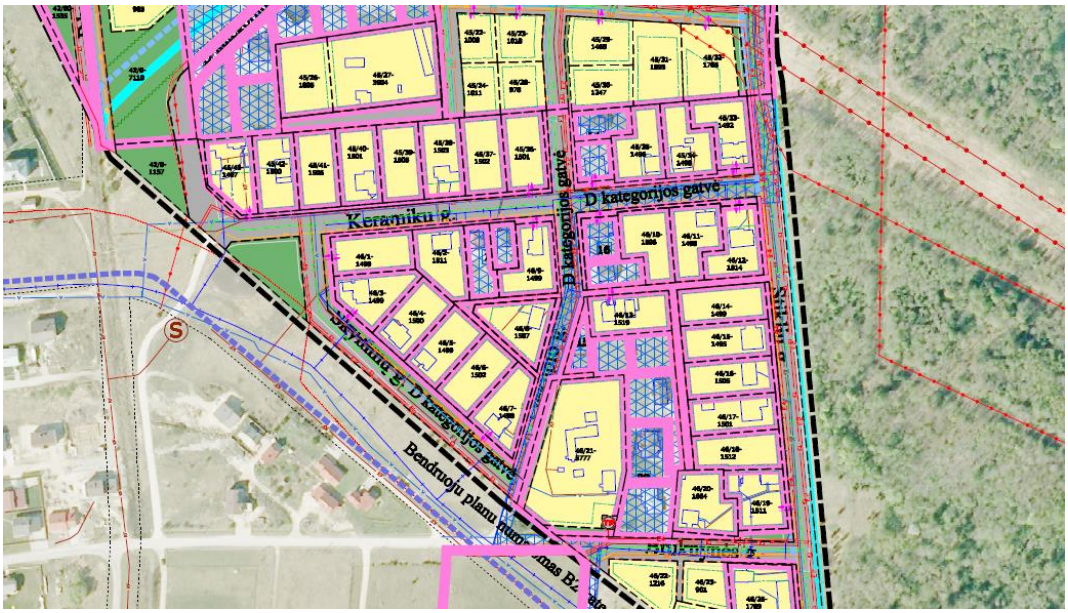

Figure 1. Excerpt from Panevėžys City residential area special plan (Teritorijų planavimo ..., 2018)

There were about 776 hectares of residential areas in the area with parcels of land with infrastructure parcels – a passage between parcels and recreational green areas.
Due to historical conditions, in several former villages (which are now part of Panevėžys City), landowners have restored the ownership rights to their former land in accordance with the methodology for returning land in the linear villages. The land parcels formed in these territories do not comply with the concept of urban development and current planning principles. Therefore, according to special territorial planning documents, about 776 hectares of land were planned as separate residential territories, forming land parcels near buildings, infrastructure and recreational green areas.
The projects developed during Phase II (detailed plan of unoccupied state land and problem areas in Panevėžys City and preparation plans of land parcels of Panevėžys City areas to budget institutions comparable to detailed plans) aimed at detailed formation of unoccupied state land and problem territories, and regulations. Land parcels on unoccupied state land (according to Panevėžys City Scheme) have been formed or submitted proposals for the possibilities of using a part of unoccupied state land, regulations for the management and use of territories have been established. Existing detailed plans were also corrected, the solutions of which did not correspond to the solutions of the current master plan or their land use disputes arose. Detailed plans of unoccupied state land and problem areas in Panevėžys City (59 units), plans of land parcels of Panevėžys City territories near budgetary institutions, comparable to detailed plans (30 units) as well as other relevant territorial planning documents were prepared. In the concept of solutions, the planned territories were approved in 2013. Prepared and approved territorial planning documents are necessary for the implementation of the solutions of the master plan of the city, development and renovation of engineering infrastructure, green areas of the city, well-being of apartment buildings. Plans of land parcels of Panevėžys City territories near budget institutions allow to perform cadastral surveys of parcels, to register parcels of land in the State Enterprise Center of Registers, thus enabling to complete the procedure of legalization of land parcel. In 2012, Panevėžys City Municipality conducted a survey on the attractiveness of public spaces to residents, the results of which showed the need to address the problem of parking shortages.

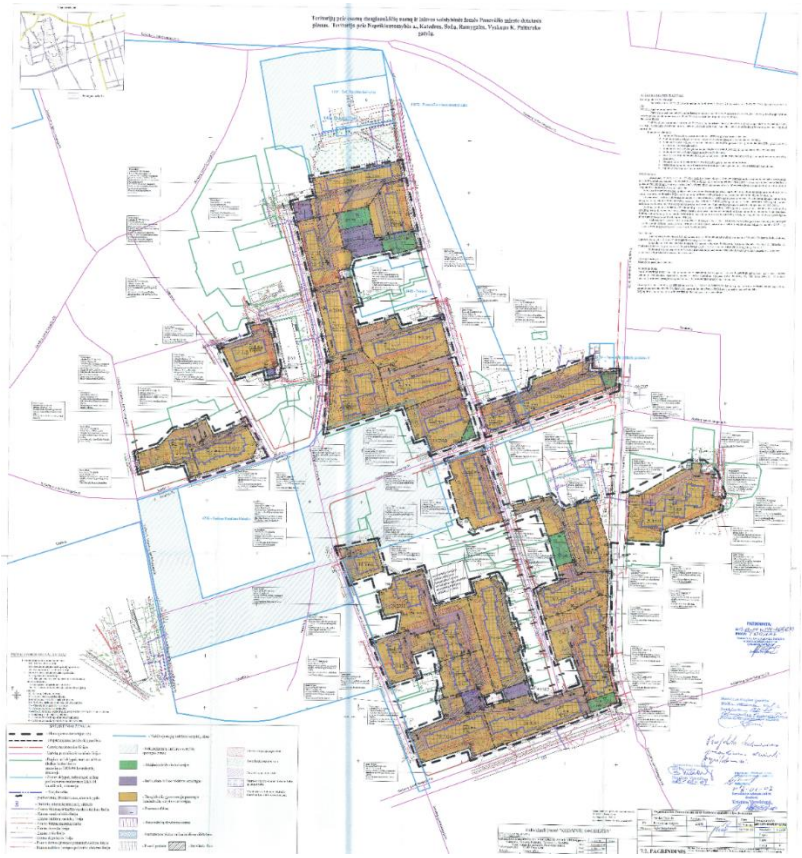

Figure 2. Detailed plan of apartment buildings and unoccupied state land in Panevėžys City Area at Independence Square, Katedros, Sodų, Ramygalos, Vysk. K. Paltaroko Streets (Teritorijų planavimo..., 2018)

During the III[rd] stage, the municipality organized the preparation of detailed plans for the unoccupied state land and problem areas in Panevėžys. The purpose of the planning is to plan the unoccupied state land and problem areas in detail, to form land parcels, to determine the regimes and regulations of territory management. In addition to the aforementioned detailed plans, the municipality has implemented several other projects, such as "Map of the boundaries of the streets in the territories of Panevėžys City Gardens "Ažuolas", „Šermutas", „Klevas" and the detailed Territorial Planning Document" plan, etc. In 2014, the detailed plan at a scale M 1:500 of unoccupied state land and problem areas in Panevėžys City, which consists of 50 territories of different size (Fig. 2), located in different parts of Panevėžys City, was started to be prepared (topographic plan of about 140 ha at a scale M 1:500 was prepared). The total area – about 158.5 ha.

The land parcels are formed according to the boundaries of the already registered parcels of land and according to the detailed plan of Skaistakalnis Park, the red lines of the planned street, the rules of land parcel formation, the existing pledge, etc. Where possible, distances of 3 m from structures to the boundary of the site were maintained and the need for separate greenery was taken into account. Efforts were also made to maintain normative indicators of the density and intensity of the building. Land uses are selected according to the main uses of the buildings and the Panevėžys City Master Plan. The planned territory No. 1 (in detailed plan) (Fig. 3) falls into the territory of Panevėžys City center.

Figure 3. Detailed plan of unoccupied state land and problem areas in the City of Panevėžys. Drawing of solutions. Planned territory No.1 (Teritorijų planavimo komisijos..., 2015)

31 land parcel (area of 10.517 ha) are formed on unoccupied state land managed by detailed plan. All land parcels formed are classified as land for other purposes, and land use patterns are different. As many as eight formed areas have been offered dual land use patterns.

Panevėžys City Municipality endeavored to participate actively in the greenery and plantation management, creation and planting program for 2013–2017, which developed the concept of Panevėžys City Greenery Special Plan. The shrinking green space for recreational purposes is a challenge to preserve the urban landscape. The preparation of territorial planning documents as one of the most effective tools contributes to the gradual improvement of the quality of the landscape, the strengthening of its ecological, social and economic functions and to the conditions for sustainable development. Changing the master plan took a long time. It has been delayed due to court proceedings (designation of heritage territories), in addition to the changes in the master plan (from January 1, 2014) the Law on Territorial Planning and others. The amendment to this master plan was only approved on November 24, 2016, but it is very comprehensive. Panevėžys City Municipality has also prepared special plans for water supply and wastewater management infrastructure, limits and management of the historic city, urban sources (Patvirtinti specialieji..., 2015). A special plan for urban greenery management was

approved in Panevėžys City, which analyzed in detail all green areas and green spaces in the city, the boundaries of these territories and the principle purpose of land use.
Recently, the municipality has been making significant changes to the detailed plans of the unoccupied state land and problem areas in Panevėžys City (approved by Panevėžys City Municipality Council in 2013-2016). In many cases, the purpose of proofreading territorial planning documents is to change the area and construction boundaries of the parcel of land, to supplement the boundaries of the engineering communications corridors and to adjust the layout of communications, etc. The adjustment shall be made during the preparation of the technical project for construction of the building, in accordance with the Regulations for complex territorial planning documents (Order of the Minister of Environment of January 2, 2014, order No. D1-8, chapter VI, section 6) in accordance with the cases of changing and correcting detailed plan solutions provided in paragraph 8 of article 28 "Complex territorial planning document solutions".
The municipality responds to emerging problems or needs. Panevėžys Municipality has a Territorial Planning Commission. Regular meetings are attended by NLS (National Land Service) representatives, specialists in architecture, infrastructure departments, lawyers, etc. The TP Commission constantly reviews problematic issues of residents, solutions of detailed plans of unoccupied state land and problem areas, ect. The joint involvement of interested parties in the territorial planning process allows for a higher quality of decisions – from site selection, task formation, tentative decisions, even to project implementation, exploitation and monitoring.
The municipality has a 3D model of the city and is developing it (Panevėžio ..., 2019). The 3D model facilitates and accelerates decision making, reasoned interpretation, alternative decision making and so on. According to experts, using this system significantly speeds up decision-making speed. The 3D reality model serves as a starting point for disagreements or for the evaluation of competitive projects, which greatly facilitates the work of the specialists of different departments. Web site (GIS ..., 2019) contains solutions for various territories (city limits, general plan, historical part of the city, detailed plans (Teritorijų ..., 2019), points of interest, bicycle tracks, noise maps, etc.).
Panevėžys City Municipality organizes preparation of land parcel formation and redevelopment projects as provided by the legal acts of the Republic of Lithuania, which aims to ensure harmonious development of territories and rational urbanization, urban quality, preserving valuable landscapes, biodiversity, as well as natural and cultural heritage values.
Table 2 shows the land parcel formation and rearrangement projects approved in Panevėžys City Municipality during the period of 2014-2018.

Table 2

Approved land parcel formation and rearrangement projects for 2014-2018 (Patvirtinti žemės..., 2018)

Year	Number, in units	Notes on State Land (SL) parcels
01.07.2018	32	Of these: 5 new SL parcels are formed; land parcels formed for exploitation of existing structures – 9; Interconnection of intervening SL parcel with other (used for other purposes) – 6, connection of SL parcels – 1.
2017	36	Of these: 7 new land parcels are formed; land parcels for exploitation of existing structures – 14; Interconnection of the intervening SL parcel with other (used for other purposes) land parcel – 1.
2016	44	Of these: 6 new SL parcels are formed; land parcels formed for exploitation of existing structures – 13; Interconnection of the intervening SL parcel with other (used for other purposes) land – 3.
2015	31	Of these: Land parcels for existing structures were formed – 17; Interconnection of the intervening SL parcel with other (used for other purposes) land – 4.
2014	13	Of these: 5 parcels were formed for exploitation of existing structures.

Panevėžys City Municipality territorial planning, implementation of these plans, real estate formation and management experience is a good example for other municipal administrations and other institutions administering real property, residents, investors, because the issues of real property formation, management and legalization of property or its use are rationalized. When state land is managed responsibly, public space management, communications and other work are better addressed, the municipal budget is supplemented with collected taxes.

Conclusions

1 At the beginning of the year state land occupied 36 percents of the total urban area in the city of Panevezys. Over the last 11 years, spatial planning documents have been developed for this whole area. It is especially important that there are planned areas next to residential buildings. In these matters, the municipality is one of the leaders in Lithuania and is a good example for others – how to rationally plan territories.

2. The solution of the territory management issues in the municipality is facilitated by the implemented 3D model of the area.

3. Territorial Planning Documents help to ensure sustainable development of Panevėžys City Territory, enable more rational allocation and efficient use of funds and resources, ensure better administrative procedures, implement strategic priorities, meet citizens' needs, and are a powerful tool for strategic planning, administration and communication in the field of territorial planning and implementation of these documents.

4. The ongoing adjustment of the detailed plans is based on the principle of continuity. It is necessary to change/determine regulations for the use of territories, to plan/re-plan the optimal network of engineering communications corridors of the planned territory, to adjust or re-establish special conditions of land use, to coordinate interests of natural, legal persons or their groups.

5. Correctly (harmoniously) planned territories according to TP documents are the starting point for further use (development) stage, further cadastral surveys of land parcel, technical projects and construction works. Territorial planning documents required for implementation of the city master plan solutions, attracting investors and property developers, developing and renovating engineering infrastructure, urban green areas, arranging multi-apartment residential areas, supplementing the state budget with possible land rent payments, etc., were prepared and approved.

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IMPROVING THE TECHNICAL POTENTIAL OF AGRARIAN ENTERPRISES

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Abstract
The technological potential of agricultural enterprise is complex system consisting of various elements with different functional capabilities and features, which are characterized by the characteristics of complex systems. The complexity of technological potential lies in the presence in structure of its several elements - technological preparation of production, equipment and technology. There is no doubt that the basis of technological potential is an active part of main production assets, namely the equipment park. Working machines and equipment, instrumentation, transmission devices and tooling - this is exactly what primarily determines the level of labour productivity. The aim of the study is to develop recommendations for efficient use of machinery of agrarian enterprises as part of their technological potential, to solve important task of developing them and improving quality and competitiveness of their products. In methodological basis of this research various methods were used: an analytical method, abstract and logical method, system approach, statistical and economic analysis, method of analogies, and method of comparative and expert estimates. The study showed that in order to increase the efficiency of use of technical equipment and more fully satisfy agricultural producers in technical services, it is necessary to create the technical centre for maintenance and repair of agricultural machines. As result, implementation of preventive strategy of technical maintenance and repair of equipment will reduce the number of machine failures by 2 - 2.5 times, increase the use of resource of their components and mechanisms by 30%, and significantly reduce the loss of agricultural products due to long downtime of mechanization equipment and crop shortages while increasing agro-technical timelines for field work.
Key words: Agriculture, efficiency, potential, technology.

Introduction

Technological potential is a component of production potential of enterprise. The need to determine the category of "technological potential" at the level of main link of the economy - organization - is obvious primarily from the standpoint of increasing the efficiency of its use at all levels of production (Лысенко М., и др., 2017). Supporting the point of view of professor Kleiner, it should be noted that technological potential of particular organization consists of following components:

- technological preparation of production;
- equipment;
- technology (technological processes) (Клейнер Г.Б., 2019).

At the same time, the degree of coordination, coherence and coordination between these components is crucial for the enterprise. Inside the technological potential, own processes take place that can be divided into three groups:

- processes of using existing technological equipment for production (production);
- processes of creation, expansion and modernization of technological equipment of the organization (reproduction);
- processes that ensure creation and development of reproductive base of enterprise itself, i.e. parts of the organization providing reproduction processes.

The technological potential of agricultural organization is the complex system consisting of various elements with different functional capabilities and features, which are characterized by characteristics of complex systems.

There is no doubt that the basis of the technological potential is the active part of main production assets, namely the equipment park - working machines and equipment, instrumentation, transmission devices and technological equipment, i.e. all that primarily determines the level of labour productivity.

The effective use of the machinery of agricultural enterprises as part of their technological potential based on the implementation of scientific and technological progress is an important task of developing the organization and improving the quality and competitiveness of products.

Methodology of research and materials

In methodological basis of this research the various methods were used: an analytical method, abstract and logical method, system approach, method of analogies, method of comparative and expert estimates, statistical and economic analysis method.

Discussions and results

At present, both at the theoretical and practical levels, unified methodology for assessing technological potential has not been developed (Melece L., Hazners J., 2017). The analysis usually starts with formation of indicators characterizing availability of agricultural machinery that has significant impact on the result of agricultural production.

Each enterprise operates and develops technologies to achieve goals and objectives in its industry. The main industry of many small agricultural enterprises in Samara region is crop production (Nipers A., et.al., 2019; Belkina E., et.al., 2019). Activities of enterprise can be assessed by main economic indicators of development (Table 1).

Table 1

The average of main technical and economic indicators
of small agricultural enterprises in Samara region

Indicator	Years					
	2013	2014	2015	2016	2017	2018
Revenues, thous. rubles	1401	449	855	1649	1746	636
Volume of marketable products, centners	1340	977	979	1138	1961	1374
Net profit, thous. rubles	151	89	75	165	170	150
Costs of main production, thous. rubles	1220	548	890	1835	1943	680
Sales expenditures per 1 ruble, thousand rubles	0.91	0.56	0.9	1.61	0.99	0.49
Average annual number of employees	6	8	8	6	9	6

Analysis showed that decrease in net profit in 2015 happened due to adverse weather conditions. In addition, as negative factor can be mentioned that state support for the agrarian sector was carried out not throughout the Samara region, but in some selected areas. For 2014 and 2015, there was a decrease in the volume of allocated funds.

To asses technical potential of enterprise it is necessary to develop the mechanism consisting of:

- scorecards for implementation of proposed methodologies;
- methods of generalization and systematization of source and calculated information;
- analysis of the results.

The need for technology has to be calculated on the basis of:

- technological maps for cultivating and harvesting crops;
- comparative economic assessment of machine and tractor units when performing different processes;
- consolidated plan of mechanized work;
- the schedule of use of machines during the calendar year.

Assessment of capacity of enterprises showed that today, on average, in the machine yard of agricultural enterprises there are different types of equipment (Table 2).

Table 2

Average number of agricultural machinery in small agricultural enterprises in Samara region

Equipment	Years					
	2013	2014	2015	2016	2017	2018
Tractors of all brands (without tractors on which the machines are mounted)	3	3	4	7	10	12
Tractors on which the machines are mounted	1	1	1	1	1	1
Tractor trailers	-	-	-	2	2	2
Seeding machines	-	2	2	2	3	3
Harvesters	1	1	1	1	2	2
Trucks	3	3	3	3	3	3

The presence of technology implies its intended use in the fields however an important criterion is the sufficiency of this equipment to satisfy all needs, ensuring the full load of equipment (Parsova V., et.al., 2018; Yanzina E. et.al., 2019) (Table 3).

Table 3

Average provision of enterprises with certain types of equipment

Types of equipment	Normative	Years						Change 2018/ 2013, %
		2013	2014	2015	2016	2017	2018	
Total number of tractors including	-	10	10	10	11	12	12	120
per 100 hectares of arable land, pcs.	1.0	0.51	0.51	0.51	0.59	0.64	0.64	110
Total number of combine harvesters including per 1000 ha of grain	-	2	2	2	2	2	2	100
crops, pcs.	3.5	2.8	2.8	2.6	2.7	2.7	2.8	100
Total number of trucks, pcs.	-	3	3	3	3	3	3	100

Analysis of availability of equipment showed an increase in certain types of categories. So the number of tractors increased by 2 units or 20%, which allowed reduce the load on one tractor due to constant area of arable land. Growth in the number of combine harvesters reflects the positive dynamics of the development of enterprises.

It should be noted that equipment park is being updated. High level of mechanization is observed in the cultivation of grain (90%). In addition, small agricultural enterprises have workshops that allow perform quick machine repair and maintenance. For determination of production capacity, the methodology, determining of balanced indicator of production capacity of enterprises have been used in the cost estimate in course of the study. To assess the technical potential of enterprises, it is advisable to use indicators and their dynamics, showed in Table 4.

Table 4

Average indicators of fixed assets of small agricultural enterprises in Samara region

Indicator	Years					
	2013	2014	2015	2016	2017	2018
Profit, thous. rubles	151	89	75	165	170	150
Fixed assets, thous. rubles	8139	8014	7768	6592	6742	7100
Average annual value of fixed assets, thous. rubles	8149	7864	5398	7944	8002	6117
Cost of active part of fixed assets, thous. rubles:						
- at beginning of the year	5040	5104	6124	6162	6618	6742
- at end of the year	5104	6124	6262	6618	6742	7082
Newly introduced funds, thous. rubles	-	-	-	-	-	-
Retired fixed assets, thous. rubles	110	58	67	70	83	-
Amount of depreciation, thous. rubles	3032	6685	6790	5044	6980	7050
Power capacity, hp	270	270	270	270	270	270
Number of employees	6	8	8	6	9	6
Area of agricultural land, ha	479	479	479	479	479	479

Analysis of fixed assets shows the dynamics of changes in indicators over past 6 years of operation of enterprises. So, the area of 479 hectares remained unchanged, slight decrease occurred in the structure of employees (by 25% since 2016). For other indicators can be noted both positive (upward) and negative (downward) dynamics. Fixed assets increased by 105% (7100 thousand rubles) compared with 2017, and growth of energy capacities remained unchanged.

Conclusions and proposals

In order to increase the efficiency of using technical equipment and more fully satisfy agricultural producers in production and technical services, it is necessary to create a technical centre for servicing and repairing agricultural machines. The repair or maintenance centre of the agro-industrial complex is

small organization, which is the team of employees armed with means of production and performing maintenance work, restoring the resource or working capacity of machinery and equipment.
The main task of such centre is the timely and high-quality performance of work in the field of technical service and repair of agricultural machinery, the restoration of components and parts of it, provision of repair production of technological equipment, improvement of technological processes and implementation of repair work at all levels of the repair network.
Main functions of the repair centre have to be:

- certification of equipment;
- development of technological processes of repair;
- organization and planning of maintenance and repair of equipment;
- maintenance, repair and upgrade of equipment;
- improvement of qualification of repair personnel.

Economic efficiency will be achieved by saving financial resources, making repair of agricultural machines and other equipment instead of purchase of new ones. The effectiveness of technical service is determined by the initial technical and economic characteristics of machines, their level of use, timeliness of maintenance and repair.
As result, implementation of preventive strategy of technical maintenance and repair of equipment will reduce the number of machine failures by 2 - 2.5 times, increase use of resource of their components and mechanisms by 30%, and significantly reduce loss of agricultural products due to long downtime of mechanization equipment and crop shortages while increasing agro-technical timelines for field work.

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LAND USE LIMITATIONS: ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS

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Abstract
Land use regulation is one of the most important state tasks and is aimed to ensuring the sustainable development of settlements. One of the mechanisms to solve this task is land use limitations establishment by restricted the possibility to carry out some activities, on certain territories or separate land plots, which would lead to negative ecological and social consequences. Such activity is becoming more and more urgent in the face of increasing ecological problems.
Land use limitations could be considering in different areas. On one hand, the feasibility of land use is governing by the methods of spatial planning, based on natural and anthropogenic conditions. On the other hand, land use limitations are the result of location of object is which could be either source of negative influence or the object is requiring being protected (mode-forming objects).
The aim of the article is to determine the impact of land use limitations on the various components of society, taking into account the environmental, economic and social components of sustainable development. Environmental and socioeconomic impact of land use limitations formation on the example of limitations caused by the activity of a mode-forming object are described in the study. The results of the study illustrate that the establishment of limitations on the land use can solve mainly environmental and social problems.

Key words: land use limitations impact, land use regulations, mode-forming objects.

Introduction

There is a need to transform the approaches and mechanisms available in Ukraine to regulate land use within the current conditions of integration processes activated at the end of the XX century.
In Ukraine, the experience of land use management under different forms of ownership began to be acquired only in the beginning of the XXI century. The methods and means of regulating decision-making issues should, first and foremost, work to improve the living conditions of the population; preserve the ecological stability of the territories; increase the value and cost of land, as well as enhance their investment attractiveness while ensuring equality of rights regardless of ownership.
Today the decision-making to ensure a balanced, sustainable and integrated development of territories is a complex task that involves many challenges and participation of a large number of entities (authorities, landowners, users, businesses).
Recently, the land use limitations mechanism has become of great importance as a regulator of providing favorable living conditions for the population and development of territories. One of the common application areas of this mechanism is a restriction of certain activity types in territories or particular land plots that lead to adverse effects. The methods and mechanisms of land use limitations existing in Ukraine are not always open, understandable and do not take into account all components of sustainable development.

Methodology of research and materials

The aim of the article is to determine the impact of land use limitations on the various aspects of society's life, taking into account the environmental, economic and social components of sustainable development.
The following tasks are aimed to achieve this goal:
1.To analyze the mode-forming objects, the functioning of which requires the organization of zones, within whose boundaries there are limitations on the use of land.
2.To perform the analysis of land use limitations.
2. To structure the land use limitations depending on various features.
3. To analyze the land use limitations caused by the activity of mode-forming object.
Research was based on the analysis of legal and regulatory acts, scientific literature and the analytical materials. The main focus was done on environmental and social impact. The theoretical debatable research results were surveyed on the examples of mode-forming objects in Ukraine. The results were

carried out used methods of collection, systematization, processing, logical analysis and generalization. The analysis and synthesis, comparison and system methods also were applied during this work.

Discussions and results

Limitations as mechanism of land use regulations

Land use regulations – ordinances of government created to ensure private and public use of land are aligned with policy priorities and standards. Land use regulations have increased substantially over the decades. Land-use regulations are an umbrella term for rules that govern land development. And limitations are an important mechanism of land-use regulations. Land-use regulations control the land development through land use limitations formation in order to achieve various safety, environmental stability, and social fairness (Land Use Restrictions as Barriers to Entry, 2008).

Land use limitation is a set of actions used to establish the optimal mode of land and land plot use. The need to set land use limitations is due to the need to preserve natural resources (agricultural, water, forest, mineral); protect historical and cultural heritage; ensure environmental protection (air, water, soil); ensure safety of life of the population; improve conditions of social life of the population. In fact, the land use limitation is a state interference with property rights. But it is justified in terms of guaranteeing free access to natural resources, social goods and aimed at protecting the common public interests and the third party rights (Petrakovska, 2010, Garrett Power, 2013)

The need to set land use limitations depends on natural resource potential, climatic conditions and ecological status.

Types of land use limitations

The study of statutory land use limitations has allowed carrying out their structuring by using different signs.

Almost all existing land use limitations can be combined into two aggregate groups:

1. Limitations, whose size and mode of use are clearly defined by the legislative and regulatory documents. That is, they are known in advance.

As an example, they include limitations imposed by different types of engineering communications.

2. Limitations governed by different types of spatial plans and social programs.

Depending on the object subject to the limitation, the limitations can be divided into 3 groups:

1. limitations that apply to a certain territory;
2. limitations that apply exclusively to land plot;
3. limitations that apply in both cases.

As a result of the analysis of the regulatory framework (Закон України «Про землеустрій», 2003, Закон України «Про регулювання містобудівної діяльності», 2011) was defined one more sign – the object features that cause limitations,

Depending on this, land use limitations may be as follows:

1. Limitations caused by the activity of a mode-forming object as a source of negative impact on the environment;
2. Limitations caused by the need to preserve existing natural resources as a whole (nature reserved fund objects);
3. Limitations caused by the need to preserve existing anthropogenic environment (cultural heritage objects).

Impact of land use limitations on the various components of society's life

The impact of land use limitations on the various components of society's life was analyzed taking into account the components of sustainable development of the territories: environmental, economic and social (Petrakovska, Mykhalova, 2018).

Decion makers increasingly accept that social impacts need to be considered along with environmental impacts because (Barrow 2002, Burdge, 1990):

- They are often closely interrelated.
- It is a wise response to the growing dremand for “social responsibility”.
- It can improve environmental management and the quest for sustainable development.

Impact on nature and environment (level of air, water basin, soil pollution, noise and vibration levels, chemical pollution, etc.) was taken into account when assessing the *environmental impact.*

Cultural (cultures of growing cities and their surroundings, cultural heritage, accessibility to cultural services) and health (psycho-physical health, impacts of traffic projects on health and living conditions, social health) impacts were taken into account when assessing the impact on social status.
Changes in the value of land and land plots were taken into account when assessing the *impact on economic situation.*
The impact of land use limitations can be assessed from the point of view of the extent of its spread. For example, groups of administrative-territorial units, separate administrative-territorial units, a group of land plots or a separate land plot. Depending on the importance of land use limitations and the extent of its spread, the impact may be local, regional, national and global. As a rule, scientists say that all impacts should be considered from local to global (Dietz, 1987).
The article analyzes the impact of land use limitations formation on the example of limitations caused by the activity of a mode-forming object on local level. According to the current legislation of Ukraine (Закон України «Про державний земельний кадастр», 2011), a mode-forming object is an object of natural or artificial origin (lake, river, forest, pipeline, energy, cultural heritage, military object etc.) under which and/or around which the land use limitations are established in accordance with the legislation in connection with its natural or acquired properties. The study revealed a significant difference between mode-forming objects. There are objects being mode-forming in essence and objects that become mode-forming only after a correspondent official status is established. The first ones include industrial objects, engineering and transport infrastructure objects, water sources, water bodies, etc.. In the second case - objects that require special protection, such as nature reserves, objects of historical heritage, health resort, etc. They legislatively establish the corresponding status, which determines the degree of necessary protection.
There are four main types of zones in Ukraine that are subject to land use limitatins: protection zones, sanitary control areas, sanitary security zones and special use areas (Земельний Кодекс України, 2001, Trevogo, Ryabchiy, M Tregub, Yu Tregub, 2019).
Protection zones are the zones established for the purpose of protecting mode-forming objects from adverse anthropogenic influences. (Земельний Кодекс України, 2001).
Sanitary control zones are the area where a special sanitary-epidemiological mode is introduced in order to prevent negative influence from outside on the protected object (for example sources of centralized drinking water supply facilities) (Земельний Кодекс України, 2001).
Sanitary security zones are the zones established around potential sources of various types of pollution in order to reduce or exclude negative impact on adjacent territories (Земельний Кодекс України, 2001).
A special group consists of special use areas that are formed around defense and military objects to protect the population, businesses and environment from the effects of emergencies. This type of restriction is not analyzed within the scope of this study.
Exploring the land use limitations impact, the following meaning was put into definitions of environmental and social effects.
Environmental impact reflects the direct effect of land use activities and their limitations on the components of the environment. Social impact is the effect on people and communities that happens as a result of active and passive land use.
Environmental and social impact studies show that both direct and indirect impacts are observed (Wathern, 1988, Sairinen, 2004). This article is focused on direct influence.
The results of analysis of environmental and social impact of land use limitations are shown in Table 1. The table shows examples of zones that are installed around mode-forming objects. There are also other types of land use limitations, such as protection zone around the objects of communication, objects of hydrometeorological activity, etc
The analysis results show that most of the land use limitations have a positive environmental impact and improve the quality of environmental conditions. Limitations on the use of land are strictly regulated by law and are aimed at complying with environmental and social standards. It is important to note that the social effect is closely related with the ecological one and is expressed in improving the comfortable living conditions of the population by preventing the negative consequences of the activity of the mode-forming object or maintaining their integrity. As well the social effect of the establishment of land use limitations is expressed by the formation of mass consciousness, which characterizes the attitude of people to socially significant events and current issues of public life.

Table 1

Environmental and social impact of land use limitations around mode-forming objects

Limitations of land use	**Mode-forming object**		**Environmental impact**	**Social impact**
1. Limitations arising from the granting of object official status				
Protection zone	objects of the nature reserve fund*		preservation of protected object which have significant importance on ecological conditions	preserving integrity of object to ensure conditions of social life (rest, studying, recovering, communication)
	objects of cultural heritage*	natural	preservation of protected object which have significant importance on ecological conditions	preserving integrity of object to ensure conditions of social life (rest, studying, recovering, communication) and historical heritage for future generations
		artificial	to provide historical value, preservation and integrity of protected object	
Sanitary control zone	health resorts		preservation of protected object which have significant importance on ecological conditions	preserving integrity of object to ensure conditions of social life (rest, recovering, communication)
2. Limitations around objects of transport and engineering infrastructure				
2.1 Objects of transport infrastructure (roads, transport interchanges, railways and so on)				
Protection zone	objects of transport infrastructure		reduction of environmental pollution (air, water, soil pollution, noise and vibration levels, chemical pollution, etc) caused by the object	improving the living comfort conditions of the population
2.2 Objects of engineering infrastructure (water supply objects, sewage systems etc.)				
Protection zone	object of heating system		preservation of protected object	improving the living comfort conditions of the population
Sanitary security zone	sewage systems		preservation of environment from harmful effects (noise and vibration levels, chemical pollution, etc.) of the object	improving the living conditions of the population
Sanitary control zone	sources and objects of centralized water supply		preservation of the protected object and ensuring of water quality	saving the health of the population
2.3 Limitations around objects of industrial objects				
Sanitary security zone	industrial objects		preservation of environment from harmful effects (noise and vibration levels, chemical pollution, etc.) of the object	improving the living conditions of the population
3. Limitations around natural objects				
Water conservation zone	water objects (lake, river, sea)		saving the quality of water resourses and preservation of protected object which have significant influence on ecological conditions	preserving the integrity of object to ensure the social life conditions (rest, studying, recovering, communication).

* There were 7 UNESCO World Heritage Objects in Ukraine as of 2017. One of them - the Carpathian beech forests - is exclusively of natural origin. Therefore, the environmental component is taken into account (Ukraine - UNESCO World Heritage Centre, 2020).

Studies of the economic effect of the formation of various zones of land use restrictions indicate a potential decreasing in the value of land and land plots that fall within the scope of restriction and and as a consequence may reduce their investment attractiveness in most cases.

As a result of analysing scientific publications by practitioners and researchers, we can identify the following features of limitations impact assessment process:
1. It is assessed the potential impact in the future - at the stage of development of spatial plans and social programs, taking into account alternative possible options for the arrangement of mode-forming objects.
2. It is assessed the existing impact of mode-forming objects on the natural and anthropogenic environment.
In the first case, it is possible to avoid negative consequences and achieve the highest possible balance between three components of sustainable development. In this case, decisions are made under the conditions of multifaceted information support and methodological basis for making management decisions regarding restrictions.
When planning for the placement of objects, economic impact, which cannot be taken into account when assessing the impact of existing objects, shall be taken into account. Therefore, it is necessary to assess the impact on the economic situation at the planning stage.
In the second case, some environmental, social and economical conditions are already existing but appeared negative consequences have to be reduced. And in this case, achieving a balance is very difficult task and in practice usually preference is giving one of the component sustainable development. The problem of finding a balance in measuring "impact" is an urgent one, especially when it comes to land resources.

Conclusions and proposals

1. The study of mode-forming objects illustrates their fundamental difference. By origin, they can be natural, artificial and natural- artificial objects. Wherein there are legally defined mode-forming objects and objects that become mode-forming only after a correspondent official status is established.
2. Land use limitations is imposed by establishing the difference zones – protection zones, sanitary control areas, sanitary security zones, water conservation zone and special use areas. The difference in these zones is that they can protect the object, the environment around the protected object, or both. The establishment of various types of zones is aimed at providing an environmental effect, as a result of which a positive social effect – improved living conditions of the population – is achieved.
3. The greatest possible balance between the components of sustainable development under setting of land use limitations can be achieved in assessing of the potential impact in the future their consequences when developing spatial plans and social programs.

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CONDITIONS AND PROSPECTS OF IMPROVEMENT OF NON-AGRICULTURAL LAND EVALUATION IN UKRAINE AS CONSTITUENT OF THE STATE LAND CADASTRE

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Abstract.
The article describes peculiarities of formation of the estimated constituent in the structure of the state land cadastre in Ukraine. The author gives analysis of the current Ukrainian practice of consideration of the intended use of a land plot while making normative monetary evaluation of non-agricultural land plots within and outside settlements. The conducted analysis of the methodology of normative monetary evaluation of the land of settlements and non-agricultural land outside the settlements confirms that in the process of evaluation, each of the methodologies considers the intended use of land plots in a different way, causing different value correlation between the lands of different categories and kinds of intended use. Differentiation of the estimated indices of the methodology of normative monetary evaluation of non-agricultural lands within and outside settlements absolutely disagree with one another. The article supplies conclusions on the necessity to transfer to a consistent approach of such differentiation without reference to the land plot location within or outside the settlements.
Basing on the analysis of statistical information on the sale of state- and communally-owned lands, the author defines the coefficients of correlation between the sale price of state- and communally-owned lands in 2017-2018 in Ukraine in terms of the kinds of intended use and the figures of the indices of differentiation of normative monetary evaluation of non-agricultural lands within and outside settlements depending on the intended use of the land plot. The author proposes changes to the approaches to differentiation of the indices of evaluation of the lands of different intended use on the base of market prices. The work also outlines the main problems and possible directions of transition to a large-scale evaluation of lands in Ukraine.
Key words: land cadastre, evaluation, land plot, non-agricultural land.

Introduction.

Nowadays, Ukraine experiences active establishment of the system of the state land cadastre. Creating the required regulatory and methodic base for its successful performance as a geo-information system, Ukraine is oriented on the key requirements to cadastre systems, which have been established in Europe and declared by the appropriate directives of the European Union and the EU organizations, which are engaged in the field of geodesy and land cadastre. The land cadastre serves as a base for economic, juridical and administrative decisions, planning and development of territories. Its geo-informational base is established on different sources and technologies, which supply collection, processing, systematization of information on land and give access to the information for a wide circle of users. For several years, Ukraine has already had the automatic system of identification of land plots, created a cartographic base of cadastre with application of aero photo and satellite images, materials of surface photography. The information on quantitative and qualitative characteristics of land plots and other objects of cadastre is getting updated, the list of cadastre information is expanded and its actuality is maintained, as well as legislation in the field of land cadastre is improved.
Implementation of the Directives of the European Union and the EU organizations in the field of land cadastre in Ukraine still has many peculiarities and specificity. Thus, the authors of the "Impact of legislative framework on the structure of the national cadastre systems" are right mentioning that the structure of a cadastre system greatly depends on the nation mentality (which also influences the legislative framework) (Лихогруд, Козіков, 2006).
The land cadastre in Ukraine still operates and is developed under the effect of those historical peculiarities, which were settled in the 60-70s of the last century in the Soviet Union. It is particularly notable concerning such constituents of the land cadastre as land evaluation. Land evaluation as a constituent of the land cadastre was approved by the Article 46 of the "Fundamentals of the land legislation of the Soviet Union and Soviet Republics", which were validated on July 1, 1969. At that time, the structure of the land cadastre included data of land use registration, accounting of quantity and quality of lands, soil assessment and economic evaluation of land. (Закон об утверждении Основ земельного законодательства … 1969). The economic evaluation of land as a constituent of the land cadastre was approved by the Land Code of the Ukrainian SSR (Validated by the Law N 2874-VII

(2874-07) of July 08, 1970, BBP, 1970, N 29, article 205). Data of the state land cadastre and particularly economic evaluation of that period were performed and mainly used for non-agricultural lands. However, it is worth noting that the need to make economic evaluation was theoretically argued and methodically initiated also for other categories of lands, distinguished at that historical stage (land of settlements (cities, towns, villages); lands of industrial, transportation, recreational purpose, reserved area and other non-agricultural use; lands of the state forest fund; lands of the state water fund).

After declaring the independence of Ukraine, to implement the land reform, which expected transition to the paid use of lands, the government initiated monetary evaluation of lands in the structure of the state land cadastre. The monetary evaluation was later divided into normative and expert ones. The first versions of the methodology of normative monetary evaluation of lands were approved by the Cabinet of Ministers of Ukraine in the middle of the 90s of the last century. Lack of experience of such works and the appropriate land market prevented applying the experience of the countries with a classical market economy in the process of their preparation. Thus, it is clear that the first version had numerous drawbacks and neglected many factors, influencing the price of real estate objects. Although land evaluation was used as a base for land payments, it caused public discontent and slowed down investments into Ukrainian economy. Considering those reasons, the methodologies have been revised many times. Referring to the legally approved land distribution into the categories, the methodologies of such evaluation were shaped for agricultural lands, lands of settlements, and non-agricultural lands except for the lands of settlements. Such division is still used. It has forced some contradictories of the evaluation procedures and methodologies, which finally caused disproportions of the obtained indices of the normative monetary evaluation, calculated by different methodologies.

Ukraine has recently introduced changes in the regulatory support and methodology of performance of the monetary evaluation of agricultural lands (Методика нормативної грошової оцінки земель сільськогосподарського призначення … 2016) and settlements (Методика нормативної грошової оцінки земель населених пунктів … 1995, Порядок нормативної грошової оцінки земель населених пунктів … 2018). The last changes, which concerned non-agricultural lands outside settlements were introduced in 2013 (Методика нормативної грошової оцінки земель несільськогосподарського призначення (крім земель населених пунктів … 2011. Порядок нормативної грошової оцінки земель несільськогосподарського призначення (крім земель населених пунктів … 2013).

There are a lot of scholars in Ukraine, who are supposed to opine that there should be the transit for the European evaluation standards (TEGOVA, 2016), International evaluation standards (IVSC, 2020), Red Paper (RICS, 2014) and wider use of international experience by applying the respective mathematical apparatus in lands evaluation (Tom Kauko, 2008; Ellerman D. 1994). The automatic model of land plots evaluation, which are based on the methods and rules of unrestricted logics, are considered to be prospective for using (Holms at. al., 2017). (Zrobek, S, 2020). Such methods are based on the theory of unclear multiples and use linguistic measures, which enables to apply the biased expert knowledge about the points of the subject without their formalization, within the frame of traditional mathematical models, for decision-making process. However, the existing Ukrainian standards of evaluation adjustment to the international ones requires their adaptation to the socio-economic conditions and regulatory, and methodical base, which are valid in Ukraine. Thus, the mentioned change is impossible unless being properly considered.

The monetary evaluation of agricultural lands does not depend on whether it is within the settled area, and evaluation of non-agricultural land plots is performed by different methods and algorithms, using different basic indices and their differentiation. Different approaches and methods of evaluation cause that non-agricultural land plots, located within and outside settlements greatly differ with no consideration of the factors of location.

Considering the current economic situation in the country, implementation of the administrative reform, which also assumes redistribution of the budget income in favor of the local government, causes significant losses and social discontent. Because of those factors, there is a need to improve the methodology of differentiation of the indices of evaluation in terms of intended use of land plots.

The problems of land cadastre in Ukraine and land evaluation as its important constituent are studied in the works of many Ukrainian scientists. Among them, the works by Yu.F. Dekhtiarenko, (Дехтяренко Ю.Ф. et al. 2007), M.H. Stupen (Ступень М.Г. et al., 2006) and many others. Concerning the topic of the present research, it is of particular interest to study the findings, which deal with the issue of relation of the results of normative monetary evaluation of the territory of settlements of different categories (Пелеха Ю.М, 2012) and methodic aspects of the normative monetary evaluation of non-agricultural

lands (Мартин А.Г, 2013). Moreover, peculiarities of consideration of the intended use of land plots in the process of normative monetary evaluation of non-agricultural lands, particularly outside settlements, are poor studied.
The aim of the article is to analyze the existing methodologies of normative monetary evaluation of non-agricultural lands and develop proposals on improvement of the procedure of consideration of the functional use of land plots in the process of their evaluation.

Discussion and results.
According to the Ukrainian laws, normative monetary evaluation of non-agricultural land plots is regulated by two different regulatory acts. The methodology of normative monetary evaluation of the lands of settlements and the methodology of normative monetary evaluation of non-agricultural lands, except for the lands of settlements, and the appropriate procedures, which specify separate methodic aspects and the evaluation procedure, sufficiently differ in terms of consideration of the functional use of the land plot.
The normative monetary evaluation of the lands of settlements is calculated by capitalization of cost for development and arrangement of the territory, calculated per one square meter with consideration of the regional coefficient, which characterizes dependence of the rent income on the settlement position in the national, regional and local systems of production and settling, the zonal coefficient, which characterizes the city-planning worth of the territory within the settlements (economic-planning zone) and the local coefficient, which considers the land plot location within the economic-planning zone. The normative monetary evaluation of a separate land plot is calculated as a product of the obtained value and the area of the land plot, as well as the coefficient, which characterizes functional use of the land plot.

Table 1

Coefficients of functional use, which are used to calculate the indices of normative monetary evaluation of lands

Section and title of the division of the intended use kinds	Number of subdivisions	Kf		
		average	min	max
Section A Agricultural lands	14	1.029	0.7	2.5
Section B Lands under residential and public buildings	27	1.166	0.7	2.5
lands under residential building	10	1.05	1	1.5
lands under public building	17	1.282	0.7	2.5
Section C Land of natural reserve and other environmental protection purpose	12	0.5	0.5	0.5
lands of the natural reserve fund	11	0.5	0.5	0.5
lands of other environmental protection purpose	1	0.5	0.5	0.5
Section D Lands of health purpose	4	0.5	0.5	0.5
Section E Lands of recreational purpose	5	0.5	0.5	0.5
Section G Lands of historic and cultural purpose	4	0.5	0.5	0.5
Section H Forest fund lands	3	0.833	1	1
Section I Water fund lands	12	0.642	0.5	1.2
Section J Lands of industrial, transportation, communications, energy, defense and other purpose	34	0.8222	0.5	1.2
lands of industrial purpose	5	0.95	0.65	1.2
lands of transportation	11	1.091	1	2.5
lands of communication	5	0,92	0.5	1.2
lands of energy purpose	3	0.65	0.65	0.65
lands of defense	10	0,5	0.5	0.5
Section K Undistributed lands, lands of the reserve fund and common use	4	0.3	0.1	0.5
undistributed lands	1	0.1	0.1	0.1
lands of the reserve fund	1	0.1	0.1	0.1
lands of common use	1	0.5	0.5	0.5
for the goals of the section K and for protection and use of lands of the natural reserve fund	1	0.5	0.5	0.5
Total	119			

The coefficient, which characterizes functional use of the land plot (hereafter Kf), is determined basing on the Classification of kinds kinds of intended use of lands (Класифікації видів цільового

призначення земель … 2010). According to the classifier, there are ten distinguished sections, which correspond to the land categories, 19 divisions of the kinds of intended use, and 119 subdivisions of the kinds of intended use (Table 1).

To make comparison, the author of the work calculated the average figures of the coefficients for the sections and the range of variation from the minimal to the maximal value. The minimal value does not include the coefficient Kf=0.5, which is determined for all groups of the kinds of land use (except for the land under public buildings) and for protection and use of the land of the natural reserve fund. Due to the great differentiation of the coefficient of functional use, its average values little variate from the maximal value Kf=1.166 (from 0.7 to 2.5) of the land of residential and public buildings, to the minimal value for undistributed lands, lands of the reserve fund and common use - Kf=0.3 (from 0.1- to 0.5).

For the lands of health purpose, lands of recreational purpose, lands of historic and cultural purpose, the value of the coefficient is the same for all subdivisions, i.e. Kf=0.5The law has set the coefficient Kf=0.5 for the majority of subdivisions (Table 2) of the intended use of land, i.e. 54 (45.4%), whereas for 29 (24.4%) subdivisions, the coefficient is Kf=1.0. The maximal value of the coefficient Kf=2.5 is set for seven subdivision of the kinds of intended use. Although for one kind, particularly 03.17 For placing and exploitation of the establishments of servicing of the visitors of recreational objects, the coefficient is Kf=2.0. The minimal value, i.e. 0.1, is determined for undistributed lands and lands of the reserve fund.

Table 2

Distribution of the coefficients of functional use by the number of the kinds of intended use

Value of the coefficient of functional use (Kf)	**Kinds of the intended use of lands**	
	number	**%**
0.1	2	1.68
0.5	54	45.38
0.65	5	4.20
0.7	12	10.08
1	29	24.37
1.2	7	5.88
1.5	2	1.68
2	1	0.84
2.5	7	5.88
	119	100.00

According to the Methodology of normative monetary evaluation of non-agricultural lands (except for the lands of settlements), approved by the Cabinet of Ministers of Ukraine on November 23, 2011 № 1278, the normative monetary evaluation of non-agricultural lands (except for the lands of settlements) (P) is calculated by the formula:

$$P = S \times D \times Ск \times Км \times Кв \times Кс \times Ki, \quad (1)$$

where S - stands the area of a land plot:

D - stands for the rent income for the appropriate category of lands (in UAH per year);

Ск – stands for the term of capitalization (in years);

Км – stands for the coefficient, which considers the land location;

Кв – stands for the coefficient, which considers the kind of the land plot use and is determined depending on the content of the lands according to the data of the State land cadastre;

Кс – stands for the coefficient, which considers the land plot belonging to the lands of environmental protection, health, recreational, historic and cultural purpose;

Ki – stands for the coefficient of indexation of normative monetary evaluation of lands.

Referring to the calculation formula, the differentiation is made by the value of the rent income, depending on the intended use of the land plot (Table 3). The lands of recreational purpose are taken as a basis for comparison. Under such conditions, for the lands of industrial purpose, the rent income is ten times higher than the one on the lands of recreational purpose, whereas the rent income on the forest fund lands is ten times less (considering different terms of capitalization, the figure is almost seven times).

Table 3

Standards of rent income for the corresponding category of lands

Category of lands	Rent income, UAH/m^2 per year	Correlation coefficient referring to the recreational lands (Ks)
Lands of natural reserve and other environmental protection purpose	0.1179	1.880
Lands of health purpose	0.0752	1.199
Lands of recreational purpose	0.0627	1.000
Lands of historic and cultural purpose	0.1191	1.900
Forest fund lands	0.0063	0.100
Water fund lands	0.0211	0.337
Lands of industrial, transportation, communication, energy, defense and other purpose	0.6637	10.585

Table 4 presents information on the values of the coefficients of functional use, which are applied in the process of evaluation of the lands of settlements (Kf) and the corresponding correlation coefficients of the rent income of normative monetary evaluation of non-agricultural lands outside the settlements (Ks).

Table 4

Coefficients of functional use (Kf) and the correlation coefficients of the rent income of normative monetary evaluation of non-agricultural lands outside settlements (Ks)

Section of the kinds of intended use	Kf			(Ks)
	average	min	max	
Section C Lands of natural reserve and other environmental protection purpose	0.5	0.5	0.5	1.880
Section D Lands of health purpose	0.5	0.5	0.5	1.199
Section E Lands of recreational purpose	0.5	0.5	0.5	1.000
Section G Lands of historic and cultural purpose	0.5	0.5	0.5	1.900
Section H Forest fund lands	0.833	1	1	0.100
Section I Water fund lands	0.642	0.5	1.2	0.337
Section J Lands of industrial, transportation, communication, energy, defense and other purpose	0.8222	0.5	2.5	10.585

The analysis of the Table 4 confirms that the current approaches to normative monetary evaluation of non-agricultural lands force a significant disproportion of estimated indices of different categories of lands. Table 5 supplies calculation of the coefficients of discrepancy of consideration of the functional use of land plots in the methodology of evaluation of the lands of settlements, the coefficient (Kf) and correlation of the rent income of normative monetary evaluation of non-agricultural lands outside the settlements (Ks). The obtained coefficients demonstrate that the greatest distortion happens in case of the forest fund lands, lands of industrial, transportation, communication, energy, defense and other purpose.

Table 5

Coefficient of discrepancy of consideration of the functional use of land plots in the methodology of evaluation of the lands of settlements

Section and title of the division of the intended use kinds	Kf		Adjusted value of the coefficient Ks (Section E =0.5)	Discrepancy coefficient			
				Ks to Kf		Kf to Ks	
	min	max		min	max	min	max
Section C Lands of natural reserve and other environmental protection purpose	0.5	0.,5	0.94	0.532	0.532	1.880	1.880
Section D Lands of health purpose	0.5	0.5	0.6	0.833	0.833	1.200	1.200
Section E Lands of recreational purpose	0.5	0.5	0.5	1.000	1.000	1.000	1.000
Section G Lands of historic and cultural purpose	0.5	0.5	0.95	0.526	0.526	1.900	1.900
Section H Forest fund lands	1	1	0.05	20.000	20.000	0.050	0.050
Section I Water fund lands	0.5	1.2	0.168	2.976	7.143	0.336	0.140
Section J Lands of industrial, transportation, communication, energy, defense and other purpose	0.5	2.5	5.293	0.094	0.472	10.586	2.117

Nowadays, in Ukraine, after introduction of transparent mechanisms of sale of the state- and communally-owned lands, there is available information, delivered on the website of the State GeoCadastre, on the results of sale of the lands of different intended use. To assess on how the current mechanisms of consideration of the functional peculiarities of land use correlate with the results of sale of the lands of different intended use, the author of the work has conducted the analysis of relevant information on the sale of land plots and the rights of their lease.

Table 6

Price of the sold state- and communally-owned land plots in 2017-2018 in terms of their intended use

Code of the intended use of the land plot	Price for 1 m^2 of the land plot		
	average	minimal	maximal
Agricultural lands	36.16	18.80	100.65
Lands under residential building	251.04	1.47	3743.48
Lands under public building	179.07	1.90	6800.00
Lands of health purpose	151.47	17.57	834.29
Lands of recreational purpose	67.43	2.27	443.31
Water fund lands	64.84	55.31	68.82
lands of industrial purpose	75.66	6.06	5809.83
lands of transportation	102.88	18.07	2977.12
lands of communication	157.23	38.52	447.55
lands of energy purpose	17.02	10.71	338.40
Undistributed lands	73.58	71.47	171.11

Calculated by the author using the data of the State GeoCadastre of Ukraine https://land.gov.ua/info/stan-formuvannia-rynku-zemel-v-ukraini

The article also provides consolidated data on the sale of state- and communally-owned lands in Ukraine in 2017-2018 depending on the intended use of the land plots (Table 6), as well as the price of the rights of the land plots lease (Table 7).

Table 7

Price of sale of the rights of lease of the state- and communally-owned land plots in 2017-2018

Intended use of the land plot	price of lease of the land plot, UAH for 1 m^2 in year		
	average	minimal	maximal
Agricultural lands	0.32	0.0036	933.4400
Lands under residential building	7.97	0.1500	335.2700
Lands under public building	22.71	0.3900	6100.1760
Lands of recreational purpose	31.23	0.8716	148.6872
Water fund lands	0.31	0.0376	112.5100
Lands of industrial purpose	7.58	0.0376	746.9106
Lands of transportation	15.23	1.7788	608.1100
Lands of communication	52.59	52.5886	52.5886
Lands of energy purpose	2.65	1.9520	6.5322
Lands of common use	8.27	8.2700	8.2700
Total	0.39	108.9359	8242.6754

Calculated by the author using the data of the State GeoCadastre of Ukraine https://land.gov.ua/info/stan-formuvannia-rynku-zemel-v-ukraini/

Excluding agricultural lands out of the conducted analysis, the author of the research studies the correlation of the indices of normative monetary evaluation of lands with the results of sale of the state- and communally-owned lands, which are officially published on the website of the State GeoCadastre. Table 8 presents figures of the coefficients of correlation between the average value of the price of sale of state- and communally-owned land plots and rights of their lease in Ukraine in 2017-2018, the coefficient of the functional use **Kf** of the current procedure of normative monetary evaluation of settlements in terms of subdivisions of the kinds of intended use. It confirms no correlation dependence.

Table 8

Coefficient of correlation between the average value of the price of sale of state- and communally-owned land plots and the rights of their lease in 2017-2018

Kind of transaction	Correlation coefficient		
	Average	Minimal	Maximal
sale of lands	0.376	0.029	0.402
sale of the rights of lease	0.443	0.114	0.394

Table 9

Coefficient of correlation between the average value of the price of sale of state- and communally-owned land plots and the rights of their lease in 2017-2018

Kind of transaction	Correlation coefficient		
	Average	Minimal	Maximal
sale of lands *	-0.026	-0.213	0.971
sale of the rights of lease **	0.195	0.999	0.996

* Because of no agreements, the analysis is conducted referring to the data of sale of the lands of the water fund, recreational, health purpose, and lands of industrial, transportation, communication, energy, defense and other purpose.

** Because of no agreements on the sale of the rights of lease of the state- and communally-owned lands, the analysis is conducted referring to the data on sale of the water fund lands, lands of recreational purpose, and lands of industrial, transportation, communication, energy, defense and other purpose.

The great coefficient of correlation between the average value of the price of sale of the rights of lease of the state- and communally-owned land plots in 2017-2018 and the coefficient of correlation of the rent income of normative monetary evaluation of non-agricultural lands outside settlements (Ks) is forced by the fact that the normative monetary evaluation is the basis for determination of the price of the rights of the land plots lease.

Conclusions.

The conducted analysis of the methodology of normative monetary evaluation of the lands of settlements and non-agricultural lands outside settlements provides the conclusion that in the process of evaluation, each of the methodologies considers the functional use of lands plots in a different way, resulting in different price correlations between the lands of different categories and kinds of intended use. The differentiation of the estimated indices of the methodology of normative monetary evaluation of non-agricultural lands within and outside settlements absolutely disagree with one another. To remedy the situation, it is necessary to transfer to a consistent approach to such differentiation without reference to the land plot location within or outside settlements.

In Ukraine, the current approaches to differentiation of the normative monetary evaluation for the purpose of consideration of the intended use of lands do not concern the pricing tendencies at the market that is confirmed by absence of correlation between the price of sale of the state- and communally-owned lands in 2017-2018 in Ukraine in terms of the kinds of intended use, and the values of the indices of differentiation of normative monetary evaluation of non-agricultural lands within the boundaries and outside settlements depending on the intended use of the land plot.

The author of the work considers that those drawbacks are caused by the fact that the above-mentioned coefficients or the standards of rent income, which serve as a basis for differentiation of the estimated indices of the land plots of different categories, are not scientifically argued. Since the normative monetary evaluation is a base for taxation, such imperfection of the mechanism can be partially substantiated by supplied privileges on tax payment.

In the work, it is proposed to change the approaches to differentiation of the indices of evaluation of the lands of different intended use and substantiate them basing on market data on the sale of lands of different intended use for a gradual transition to a large-scale evaluation of lands in Ukraine according to the international standards.

Simplification of the procedure of change of the intended use of land plots by the landowners also forces the need to develop a new version of the classifier of the kinds of intended use of land plots in Ukraine.

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CADASTRAL DATA AS A BASIS FOR RATIONAL USE AND PROTECTION OF LAND

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Abstract
Without cadastral information, it is difficult to make any decisions about land. But in order for the system of state land cadastre to work effectively, it is necessary that the information in it is up-to-date, complete and reliable. The article analyzes in detail the existing legislative and regulatory acts and draws conclusions from the methodological principles of keeping the state land cadastre in the part concerning the consideration of factors of influence on the quality of land accounting. The status of agricultural land use was monitored and land conservation measures recommended. The authors have analyzed in detail the public information on the soil cover of Ukraine, which is displayed on the Public Cadastral Map of Ukraine. The necessity of enrichment of the cadastre with new information and indicators is investigated, which allows to solve a wider range of problems regarding the use of land as a spatial basis and the purpose of development of the multifunctional cadastre.
Keywords: the state land cadastre, rational use, land plot.

Introduction
Cadastral data should be the basis for rational land use and protection, which implies the creation of a favorable ecological environment and the improvement of natural landscapes. In the crisis situation of the livestock industry in Ukraine, when the livestock population has fallen sharply and the production and application of manure has fallen significantly, there is a need to find ways of replenishing the organic part of the soil through the use of alternative organic fertilizers. Reliable information on the quality of the land as a whole and in particular the soil cover should be reflected in the national cadastre system (Tykhenko, 2016; Bavrovska, 2016). Land use in Ukraine should be considered in the context of multi-purpose use, which is defined by the legal norms of land use.
Many countries also consider it desirable to develop plans for improving agriculture and developing the rural economy. Mapping data on land use provides the necessary basis for the accumulation and classification of knowledge about available resources (FAO, 2003).
The basis of rational use and protection of land should be reliable information of the state land cadastre on soil cover. Unfortunately, in Ukraine, this information is mostly outdated, and the soil layer is informative in relation to the soil cover of Ukraine. At the same time, the following layers were created in 2019-2020 to plan measures for rational land use and land use control: "Classification of crops 2019 (Yarov)," Classification of crops 2019 (Winter) "," Crops on unregistered lands in 2019 »That are informative in nature and allow you to track the current state of crops.
Nevertheless, the debate about the nature and contents of the inventory of land as a mean of obtaining, updating and correcting information on the status of land ownership and land use, which entered into the State Land Cadastre of Ukraine are continuing nowadays.
The purpose of the article is to analyze the data of the state land cadastre of Ukraine on the information needed for rational land use and to identify the shortcomings that have emerged. In order to achieve this goal, the following tasks have been solved: The state land cadastre has been filled with data on agricultural land; the reliability of information on the soil cover of Ukraine as a basis for rational land use is investigated.

Methodology of research and materials

The object of the research - the cadastral information system of Ukraine (Public cadastral map of Ukraine). The article discusses the publicly data that is present on the Public Cadastral Map. The following methods were used for the research: monograph (in elaboration of scientific works on problems of rational land use); abstract-logical (when substantiating the theoretical basis of cadastral data as a basis for rational use and protection of land); analysis and synthesis (for a comprehensive assessment and justification of the current state of filling the cadastral system, analysis of foreign cadastral systems); systematic, statistical

Results and discussion

It should be noted that it is very important that land use is possible only on the basis of complete cadastral data (András Osskó, Jan K., B. Sonnenberg, 2002; D. Platonova, A. Jankava, 2012; Irene Suárez Fernández, 2008). Land consolidation can be an effective tool for rural development through better management of natural resources, rationalization of land ownership structure, and prevention of potential conflicts arising from land restructuring for other uses (Platonova, & Jankava, 2012). Land consolidation must address the problems of land fragmentation and be ensured by a permanent institutionalized body. The cadastre and registration system is an important source of information on the mapping of individual parcels and real estate objects using cadastral maps in land consolidation (Irene Suárez, 2008).

The cadastral system is the main source of accurate information about land plots and their attributes. Land information systems have a number of advantages, given both the definition of rights and registration of existing land rights, value and use, and changes that affect human-land relations according to the changing nature of land rights, land value; and land use in general (Abdeslam Moulay Adad, 2019).

Both in Ukraine and in the world, there is a clear trend towards the development of a multifunctional cadastre based on various information on land resources. This creates new opportunities for enhancing the rights of landowners and land users, enriching the cadastre with new data and metrics, enabling a wider range of land use and spatial use (Kovalyshyn, & Kryshenyk, 2018; Tykhenko, 2018). The formation of the modern land cadastre system was influenced by the social and economic transformations that took place in society: the land cadastre has evolved from a accounting system to a modern information system, the data of which should be the basis for efficient, environmentally sound land use.

The state land cadastre is maintained for the purpose of providing information to state authorities and local self-government bodies, individuals and legal entities in the organization of rational use and protection of land (Law Ukrainy, 2011). According to Article 33 of the Law of Ukraine "On the State Land Cadastre", the quality of land records reflects the data characterizing the lands by natural and acquired properties, affecting their productivity and economic value, as well as by the degree of man-made pollution of soils. In accordance with the Law of Ukraine "On Land Protection", the following standards are set in the field of land protection and soil fertility reproduction: maximum permissible soil contamination; the quality of the soil; optimal ratio of land; indicators of land and soil degradation. The maximum permissible soil contamination standards are determined in order to establish criteria for the suitability of land for their intended use.

The rational use of the land depends directly on its purpose, because only by operating a clearly defined purpose of land exploitation can develop a list of specific methods of its use, determine the peculiarities of the allocation of productive forces within the land, establish the composition of land, and control the rational land use. The current level of fertility of agricultural land is catastrophically low.

The regulatory purpose of the cadastre for agricultural land is based on the effective use of land resources to provide the population of the country with food and agricultural raw materials - industry, as well as the introduction of a system of measures for the protection of land resources, including the preservation and reproduction of soil fertility. Therefore, the primary task of landowners and land users is to constantly restore the fertility of the land, and this can be achieved through its rational use.

One of the main tasks of the cadastre of Ukraine is to fill in 100% of the State Land Cadastre with reliable and complete information about land plots, boundaries of administrative-territorial units, regulatory monetary valuation and data on indicators of land quantity and quality accounting. Thus, the State Land Cadastre of Ukraine has entered information about 73% of land plots, of which 13.9 million agricultural land plots with a total area of 30.4 million hectares (Figure 1, Table 1).

As a moratorium on the sale of agricultural land was introduced in Ukraine, it had a significant impact on the types of transactions for agricultural land. Yes, the lease is 76.1%, the inheritance is 18.33%, and the mine-donation transactions are only 1.6% (Figure 2).

The territory of Ukraine is 60.357 million hectares, of which 42.724 million hectares (or 70.8%) are agricultural land. Of these, 98.6% are rural and only 1.4% are urban. In rural areas, the share of agricultural land is the largest among other purpose land (71.9%), followed by forests and arable land (17.5%). In cities, the largest share is built-up land (housing, industrial land, etc.) - 35.3%, and agricultural - 31.1%. The characteristics of the purpose of land and the distribution of forms of ownership differ significantly between administrative and territorial units.

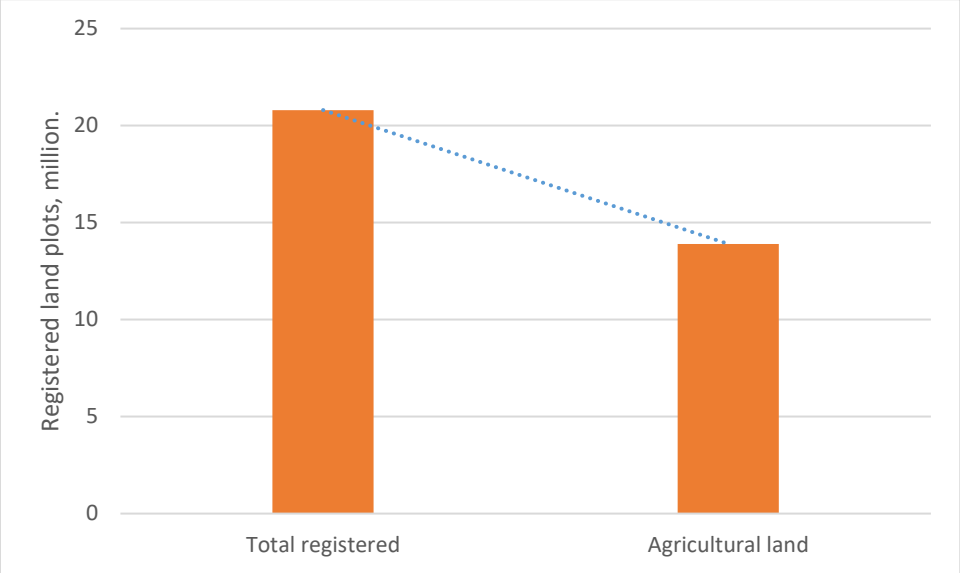

Figure 1. Information about the agricultural land plots entered in the state land cadastre, 2019 (Compiled according to the State Geocadastre of Ukraine).

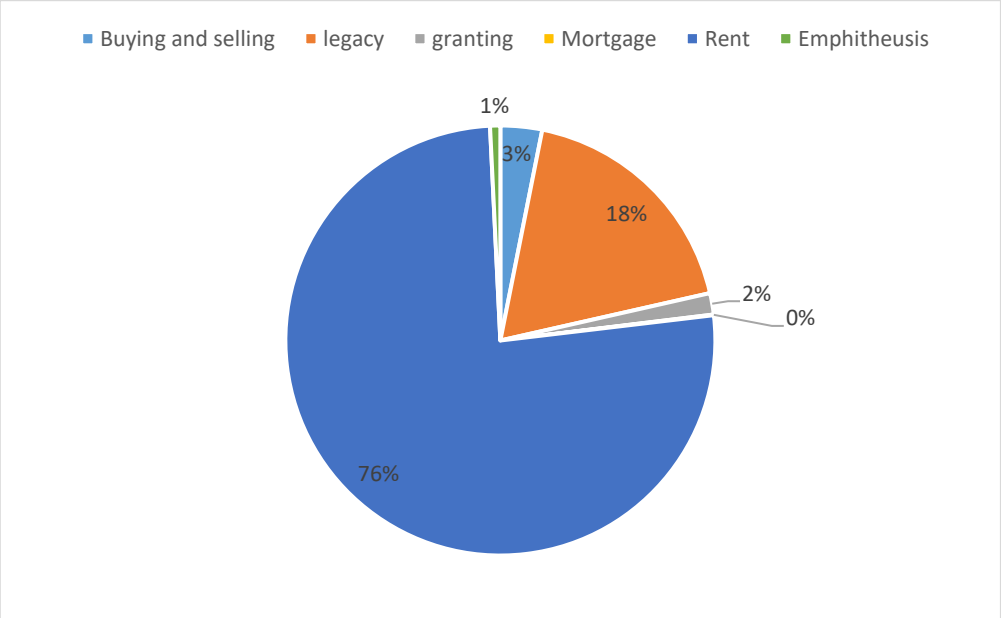

Figure 2. The share of types of transactions among agricultural land

Analyzing the data in Table 1, we can see that in Ukraine the largest percentage of unregistered land in the state land cadastre is in the Zakarpatska and Ivano-Frankivsk regions and the Autonomna Republica Krym (more than 50%). Only Vinnytsia, Dnipropetrovsk, Zaporizhia, Khmelnytskyi Cherkassy regions the state land cadastre contains the most information about land plots.

Table 1

Information on land outside the settlements, which are not included in the automated system of the State Land Cadastre (on 01.10.2019)

No	Name of administrative territorial unit	Total area region, thous. hectares	Area of unregistered land, thous.hectares	The percentage of unregistered land (%)
1	Vinnytsia region	2646.4	428.8	16.2
2	Volyn region	2013.2	816.6	40.6
3	Dnipropetrovsk region	3192.1	433.5	13.6
4	Donetsk region	2636.7	774.9	29.4
5	Zhytomyr region	2983.1	969.7	32.5
6	Zakarpatska region	1275.9	790.4	61.9
7	Zaporizhia region	2723.1	507.1	18.6
8	Ivano-Frankivsk region	1385.1	717.3	51.8
9	Kyiv region	2815.6	904.7	32.1
10	Kirovohrad region	2456.7	537.2	21.9
11	Lugansk region	2667.5	1105.1	41.4
12	Lviv region	2153.3	1006.2	46.7
13	Mykolayiv region	2462.4	550.3	22.3
14	Odesa region	3327.4	970.0	29.1
15	Poltava region	2868.0	595.1	20.7
16	Rivne region	2005.3	479.3	23.9
17	Sum region	2369.3	605.8	25.6
18	Ternopil region	1382.0	286.1	20.7
19	Kharkiv region	3140.0	997.5	31.8
20	Kherson region	2946.7	796.2	27.0
21	Khmelnytskyi region	2047.9	361.0	17.6
22	Cherkassy region	2083.0	297.5	14.3
23	Chernivtsi region	808.6	303.1	37.5
24	Chernigiv region	3182.9	935.6	29.4
25	Autonomous Republic of Crimea	2609.5	1463.8	56.1

Therefore, land reform and restrictions on the land market must take into account local characteristics. The poor state of land resources in terms of their environmental and economic performance indicates the need to optimize land use. No effective mechanisms for protection of especially valuable lands have been created so far.

One of the systematic manifestations of the cadastre is the Public Cadastral Map, as a way to simpler and more convenient relations with citizens and with the state apparatus. In each country there is a national system of cadastral structuring, which takes into account the specific features of the economy and geographical location of the country, its traditions, the mentality of the nation, etc. and, most importantly, performs its functions. Since 2013, orthophoto plans have become the cartographic basis for Ukraine's public cadastral map. New layers have been created when developing a single integrated inventory system that will contain information about the country's natural resources. They can serve as a powerful tool for displaying land use and further a basis for developing a set of land use and conservation measures. Yes, the soil layer, which was created by vectorization of the soil map of Ukraine M 1: 200 000, but it is informative in relation to the soil cover of Ukraine. Although, for the rational use and protection of agricultural land, information on soil cover is paramount and necessary.

As the soil cover of Ukraine is very diverse, there are about 800 soil types, their detailed examination and actual display on the soil map is necessary. Black Earth soils, along with high productive fertility, are susceptible to degradation, which is often due to their irrational use. Humus is the main source of energy for the processes of conversion of mineral compounds into soil and an integral indicator of soil fertility.

The use of soil solely as a source of profit without concern for its protection, excessive plowing has led to a critical condition of soil in Ukraine. In Ukraine, 57.5% of agricultural land is undergoing erosion and these processes continue. Saturation of crop rotations with intensive mineral nutrition, significant reduction of fertilizer application, spread of erosion processes have led to a negative balance of humus in many regions of Ukraine. That is why it is necessary, in addition to displaying the soil cover itself in the land cadastre, to map the quality maps of the soil of Ukraine.

Conclusions

1. Lack of qualitative characteristics of land plots in the cadastral system of Ukraine significantly complicates state control over land use and protection, as there are no grounds for levying fines for reducing soil fertility.
2. Soil quality standards determine the level of contamination, optimal nutrient content, physicochemical properties. These indicators should be the main source of information for the formation of the National Cadastral System database on land quality characteristics and the basis for rational land use and protection.
3. The information of the soil layer on the public cadastral map of Ukraine not only does not correspond to the nomenclature list of agricultural production groups of soils, but is also inaccurate in some places, as it is related to the obsolescence of soil information, which was based on large-scale soil surveys, which are already extensively surveyed. Decades have not been spent.
4. Geospatial data is the basis for developing and monitoring adherence to a country's development strategy, a tool for integrating it into the global information space, and transforming the cadastre into a multi-purpose is a relevant and timely task. The poor state of land resources in terms of their environmental and economic performance indicates the need to optimize land use.
5. To obtain reliable information on the state of agricultural land, a state program of land protection measures is required, with detailed surveys involving landowners and users using leased land.

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