On creating digital land management in the framework of the program on digital economy of the Russian Federation

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Abstract. The article deals with the problems of modern land management and land use planning in the context of the new program of development of the country on the basis of the digital economy. Informatization of all branches of knowledge, caused by scientific and technological progress, determines the level of development of economic sectors, including land management. These and other reasons suggest the need to create a new concept of modern land management on the basis of its full digitalization.

1. Introduction
The sphere of modern technologies is a priority for development in Russia, which is confirmed by the adoption and implementation of the program “Digital Economy of the Russian Federation”, approved by the decree of the Government of the Russian Federation No. 1632-p of July 28, 2017.

Practically all the problems of modern land management and land planning need to be considered today in the context of the country’s development program based on the Digital Economy of the Russian Federation, approved by the decree of the Government of the Russian Federation No. 1632-p dated July 28, 2017.

In this regard, it can be stated that the Russian Federation needs a new concept of land policy and land management, improvement of the paradigm for regulating land and property relations, an updated land management system based on the conceptually new state management system that is controlled and supported by the state at all levels, being a concentrated and managed single structure.

2. Proposals for the Concept of Digital Land Management
Creating digital agriculture on the basis of smart land use cannot be done without creating digital land management. In fact, digital land management is the basis, because it is the spatial reference of all digital agriculture, including all issues of precision farming based on adaptive-landscape approaches, land monitoring issues based on field monitoring, effective planning and rational use of land resources using GIS, CAD, and information and communication technologies (ICT), as well as on the basis of a comprehensive account of the large number of factors affecting the design and management decisions.

Land management digitalization cannot be done without creating a unified integrated information system with access to forecasting land use, designing automation based on automated land planning
design systems (SALMD), expert analysis of land use based on neural network analysis, expert and intelligent systems, ICT, etc.

The project for the digitalization of land management is a complex systemic task, affecting the maintenance of land management and the entire land management system of the country, requiring cardinal, including structural changes, changes in the logic of subordination and the interrelation of government and departmental structures with the designation of a single territorial linkage and dependence on the characteristic features of interaction.

The project for the digitization of land management or the creation of digital land management should be broken down into implementation steps according to the roadmap we are developing. At the first stage, it is necessary to develop and put into operation an integrative-integrated automated system for designing land resources for agriculture and rural development (ICAS-AGRO) on the basis of which already developed models and software products (including (SALMD) can successfully function, providing many aspects of the analysis of land use and land planning, as well as all related electronic services of the agro-industrial complex.

Thus, digital technologies of smart agriculture, in the management system of the agro-industrial complex through the bundle “smart land use – smart field” should be necessarily integrated on the basis of digital land management. Otherwise, the absence of a systemic generator in the form of “land management” will lead to huge economic losses (which is happening now), which manifest themselves in the under-utilization of land resources, accelerating the rate of land degradation, simplified non-rational principle in land use, etc.

These approaches can be implemented through the creation of an integrative-integrated computer-aided design of land resources for agriculture and rural development (ICAS-AGRO), which is a software platform for the integrated design of land use processes in agriculture and other sectors of the rural economy, in the programs of sustainable rural development, as well as the technological environment for the interaction of all interested participants of land management activities, including land resource designers, land users and landowners, credit and financial organizations, expert and controlling organizations.

The system can be created on the basis of previously developed mathematical models and autonomous functional software modules, including:

- A discrete model of crop rotation taking into account the cost of maintaining fertility;
- A discrete model of allocation of land plots at the expense of land shares on the basis of preferences of real estate investors with the formation of optimal land areas for the application of modern farming technologies;
- Methodologies for analyzing the spatial variability of yield characteristics depending on the conditions of the agrolandscape, including relief (morphometric characteristics);
- A unified systematized database of field experiments of the Agricultural Agricultural Service of the Ministry of Agriculture of Russia and the Agrogeos geo-network;
- A module for automated yield assessment depending on agroclimatic, soil conditions, and agrolandscape (an experimental model was developed for one of 23 large agroclimatic regions);
- A module for automated construction of optimal rotations (an experimental model has been developed);
- A module for the automated calculation of the cadastral value of agricultural land (an experimental model has been developed; in addition, there are results of implementation using this module of government contracts for calculating the cadastral value of agricultural land in 24 subjects of the Russian Federation);
- A module for automated work with cartographic information (an experimental model has been developed).
The general concept of this approach is the creation of an automated system of flexible support for multi-step processes for the adoption and implementation of long-term collective decisions in the field of land use based on semantic web technologies (Figure 1).

Figure 1. Global intelligent electronic cooperation in the field of land use [19].

The system will provide a wide range of interested users with access to automation tools for land planning based on information on agricultural lands and rural areas.

The system should enable the implementation of a long-term strategy for structuring the land market and technologizing land management design services.

Creation and subsequent use of the system can reduce the transaction costs of agricultural producers when they use modern innovative technologies of agriculture by ensuring the optimal inclusion of such technologies and technological complexes in the production system in the development of land management projects.

The development and implementation of a system will open the strategic direction of automation and optimization of land management design processes and the implementation of rural development projects.

The implementation of such a project should lead to the following results.

The integrated complex automated system for designing land resources for agriculture and rural development (hereinafter referred to as ICAS-AGRO or Sistem) is a complete software package, each of which modules, if necessary, is able to work autonomously and be integrated into third-party software systems solving related problems.

The IKAS-AGRO system is designed to automate land management design, including the implementation of land management projects of various kinds and their economic justification, bringing them to industrial implementation with online access to the capabilities of the System through a web interface.
3. Basic Requirements for the System
The system provides the user with the capabilities (tools) of land planning automation, including:

- Coordination of work of specialists working on a single project in a distributed mode;
- Conducting approvals and examination of projects with giving the project a regulatory status;
- Supervision of project implementation;
- Updating projects and making changes to them during the period of their implementation;
- Monitoring the implementation of projects with the fixation of monitoring results;
- Archiving and storing projects and generating standard solutions on their basis;
- Using standard projects or individual decisions and information in subsequent works on land management design;
- Rapid assessment of the potential of land resources and their use in production projects (for all stakeholders).

As the System develops, the issue of providing an automatic mode of information exchange with other specialized information resources (distributed databases) and software and hardware complexes will be resolved in stages. The information exchange will be organized with state and municipal information resources created and maintained by the Ministry of Agriculture of Russia, the Federal State Registration Service, other agencies, services and authorities, as well as resources of commercial organizations. To this end, when developing the System, the formats and interfaces of the database will be coordinated with the existing government and commercial systems.

Ensuring the growing demand for food is largely a question of engaging in the production of new tracts of fertile land, the main source of which in the future will be Russia. With 20% of the land resources of the world, Russia, with the application of modern technologies and forms of organization of agriculture, will be able to provide about 1.5 billion people with agricultural products; together with the countries of the CES and BRICS, this figure grows up to 3 billion people. At the same time, the dynamics of the land services market over the next decade will be closely related to the dynamics of the agricultural products market, since the involvement of land in agricultural production is based on carrying out mass work on land management (among which are: land inventory; territorial planning schemes, land management projects, etc.).

The application of the proposed System with “… a set of software modules of the SAPR should form a comprehensive informed solution of interrelated tasks of land management with achieving the maximum economic effect as a result of automation, and obtaining additional products not only due to a better land management solution, but also as additional surplus value”.

Thus, when designing the System, solutions are used that are applicable to any national land management system (building an intelligent three-dimensional digital model of the territory based on land clusters and other model objects, providing tools of three-dimensional design, attracting and interpreting data on soil composition, climatic conditions, erosion processes etc., production and technological, transport and logistic modeling of farms). At the same time, for the adoption and justification of specific design decisions, standards and criteria are used that are established by the national regulatory acts of the Russian Federation (overwhelmingly developed and approved in the Soviet Union, which had one of the best schools in the world of land management). Changing these standards and criteria will allow to develop projects in other national land management systems, for which it is necessary to separate the legal and accounting aspects of land relations (implemented under national legislation) from the substantive issues of land design as an economic resource [11].

Thus, the use of the developed System may be relevant, firstly, for the countries formerly belonging to the USSR and implementing similar approaches in land management (Belarus, Kazakhstan, Moldova, Georgia, Tajikistan, Ukraine) and for the countries developing on the Soviet land management system (China, Mongolia, Vietnam, etc.), as well as for the countries that do not have developed any established systems for designing land resources for economic purposes, monitoring, and controlling land use.
The success and timeliness of the implementation of mass works on land management depends on the degree of readiness of land management production, which today relies more on scientific and experimental developments and ICTs, as well as specialists oriented by the professional competencies of the modern system of higher land management education. Therefore, in the preparation of bachelors it is proposed to use the following competencies that they must master:

1. An ability to collect, analyze, and summarize the initial data on land management facilities necessary for calculating the economic and socio-economic indicators characterizing the activities of business entities using information and communication technologies, remote sensing data, UAVs, laser scanning in a digital land management system.
2. An ability to develop land management documentation based on a comprehensive analysis of the natural, economic, and social conditions of land management facilities, the impact of technological and anthropogenic factors on the territory and the environment in order to substantiate land management solutions based on digital land management.
3. An ability to critically evaluate the proposed options for land management schemes of the territory of the Russian Federation, subjects of the Russian Federation, municipal formations, projects of inter-farm, on-farm land management, and working projects on land use and protection, as well as land surveying and land surveying projects, developing and justifying proposals for their improvement taking into account existing legal regulations, criteria for socio-economic and economic-environmental efficiency, the risk and to the possible consequences of using technology digital land.

Accordingly, masters are offered the following competencies that they must master:

1. An ability to formalize the problem tasks of land management for their solution based on the use of GIS technologies and SALMD, other means of digital land management;
2. An ability to collect, analyze and process data necessary for solving the set land management and economic tasks based on the use of GIS technology and databases and other means and technologies of digital land management;
3. An ability to solve the set of land management and economic tasks by the methods of automated land management design, other methods of digital land management;
4. An ability to use various software available for use in solving land management and related tasks.

At the same time, the addition or updating of competencies should also be accompanied by the creation of new bachelor and master profiles in the areas of land management and cadastres to prepare graduates who are ready to create and maintain digital agriculture based on smart land use and digital land management.

For this purpose, the following additional educational training profiles are proposed for the “land management and cadastre” direction: the use of computer equipment and digital technologies in land management; applied mathematics and programming in land management and cadastres; applied informatics and programming in land management and cadastres.

4. Conclusions
In order to improve the Land Service of the Russian Federation, increase the effective and efficient management of land and other (depending on the use of land) resources of the country, the following aspects must be ensured [9, 10]:

1. To ensure the implementation of mass work in the field of land management (land inventory, forecasting the use of land resources based on land management schemes, etc.) in order to carry out a comprehensive reform of the entire industry. It is also necessary to reform the land management service of the country and concentrate its main functions, including federal,
regional, and local land management authorities, as part of the Federal Agency for Land Use and Land Management, which is directly subordinate to the President of Russia.

2. To transfer the function of providing state services in the field of land management on agricultural land from the Ministry of Economic Development of the Russian Federation to the Ministry of Agriculture of the Russian Federation in the appropriate Department of Land Use and Land Management of agricultural land subject to the Federal Agency for Land Use and Land Management.

3. To develop and implement a federal target program (subprogram) “Creation of Digital Land Management and Implementation of Priority Types of Land Management and Related Work in the Territory of the Russian Federation (2019-2025)”. For this, it is necessary to create a research infrastructure (scientific research institutes, problem laboratories at land management universities, etc.) to develop and maintain improved computer and information support for the industry.

4. Develop and implement the Federal Target Program “Land Resources and Land Management of Rural Territories of the Russian Federation (2019-2025).” Conduct on its basis a full optimization of the use of land resources of the country.

5. Calculation of the expected economic effect from the use of FTPs (subprograms) “Creating Digital Land Management and Performing Priority Types of Land Management and Related Work on the Territory of the Russian Federation (2019-2025)” and reducing the time compared with traditional methods showed that the expected economic effect, only from replacing traditional approaches and automating calculations with modern technologies will result in 15.9 billion rubles, with a total expenditure of 2.6 billion rubles on the implementation of the program. At the same time, taking into account that the total estimated number of facilities required for carrying out the entire designated land management complex is about 1.8 million facilities. At least 1 million performers need to be specialists only in land management for five years, which would provide stable employment, not only in land management but also in related (dependent on land) of the national economy sectors.

6. In general, the expected annual full effect of the application of the above-mentioned Program of activities for the year of their development will be more than 100 billion rubles. According to our calculations, with regular and timely implementation of all types of land management, the specified level of annual revenues should increase in all related and land-dependent industries and give an annual additional income increase from 30 to 40%, which is calculated on the total effect of land restructuring and digitalization will exceed 1 trillion rubles annually.

7. To organize (on the basis of federal educational and methodological associations of universities, or FUMO), the Centers of digitalization of the AIC for solving applied problems and developing software (application packages are the modules of the AIC information system).

8. On the basis of leading universities, it is proposed to develop open additional educational profiles for bachelor and master degrees in “Land Management and Cadastre” areas for training specialists in the field of digital land management.

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