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## ORGANIZATIONAL SUPPORT FOR AUTOMATION OF LAND MANAGEMENT PROJECTING IN IRRIGATED AREAS OF UZBEKISTAN

### ABSTRACT

The article describes in detail the ways in which agricultural enterprises operating in irrigated regions, including farms, create automated systems for the development and implementation of internal land management projects, the use of specialized expert systems based on artificial intelligence in assessing projects and their economic efficiency. Geographical information for the internal organization of farmland, in particular, the design of irrigation plots, crop rotations, forest plantations, field paths and irrigation canals, which are key elements in the territorial arrangement of the proposed sowing areas; ways to create such projects with wide application of GIS technologies in a short amount of time at low cost, as well as promptly eliminate deficiencies identified by expert systems. It is explained that the introduction of expert systems based on artificial intelligence into the practice of projecting of land management is more cost-effective than traditional estimation methods.

**KEYWORDS:** land management, project, automated systems of land management projecting, land information systems, expert systems

### INTRODUCTION

Economic success is ensured by the creation of economic and organizational support of any event and its improvement in accordance with modern requirements. In particular, the use of modern information structures in various land management works in the irrigated territories of the country has allowed the creation of a new scientific direction “information support for land management”. It is worth noting that this trend has been developing slowly in Uzbekistan over the years, especially in modern land, agrarian and economic reforms. The problems of the formation and regulation of its economic and organizational support based on land management automation for some time have been one of the main areas of research by a number of scientists from the Commonwealth of Independent States (CIS) countries [Papaskiri, 2013; 2011; Volkov, 2010]. Issues of economic and organizational support for land management automation in the regions are still not fully resolved. Obviously, the automation of organizational and economic mechanisms of theoretical issues and practical significance. It is the development of theoretical provisions of the organizational and economic mechanisms of automation of land management projects in the process of land management for the irrigated regions.

### MATERIALS AND METHODS OF RESEARCHES

This research is based on the methodology of a systematic analysis of economic, environmental and social interactions in the region. It is based on theory about the land, theoretical and practical recommendations of Uzbek and foreign scientists, rules about the role and development of the automation the information support in land management and in projecting land management are set. Today, land management in the republic is characterized by a significant loss of state and

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systemic nature, as a result of which a new land management system is being formed, the legislative framework in land relations and, in general, land policy is changing, and the problems that have accumulated in recent years are being addressed and the introduction of a qualitatively innovative, intelligent land management based on modern technologies [Papaskiri, 2011].

Along with the growing demand for land management, in particular, inter-farm land management related to the allocation of land for various purposes, the technology of its transfer began to change, which led to the penetration of information and communication technologies (ICT) in various areas of human activity. Today this is due to the emergence of a new information society. Information support for land management, therefore, now gives the logical side to this. It is well known that information plays an important role in the development of productive forces and industrial relations in modern society, and is also regarded as an object and instrument of labour, that is, not a resource, but a product of a specific activity. The work is carried out in our country over the past 25–30 years for the use and accelerated the development of ICT for the collection, storage, processing and transmission of data has led to radical changes in the economy and in the social sphere, having a profound impact on the life of every person in society. The role of information and communication technologies as one of the key factors in ensuring sustainable economic growth, a favourable innovative climate and, ultimately, improving the standard of living, is a comprehensive modern analysis and solution of emerging problems and events in this area a policy needs to be developed.

The transition to the information society enhances the role of information in solving problems of public administration, including land management. Therefore, the acquisition, storage, search, objective understanding and active use of information are of national importance, since it takes a certain amount of time and resources to create special systems based on the latest technologies and technologies. Working with information is becoming a widespread and popular profession. And the information itself is the main source of acceleration in all aspects of society. Information support includes the following components: the information itself; information Technology; information processing staff; spatial data infrastructure [Volkov, 2000]. Thus, a new scientific direction – the information support of land is appeared to ensure uninterrupted operation of the system [Papaskiri, 2016]. With the modern growth of information and the globalization of agricultural production, there is a global tendency to increase the level of methodological universalization, technological unity and the functional formation of information support for all types and types of land management along with land management processes [Volkov, 2014]. For this, first of all, it is necessary to create a database based on accurate and reliable information. At the same time, a land monitoring system will become an important source of comprehensive land management information.

The use of expert systems mentioned in scientific research is provided for the internal organization of the territory of agricultural enterprises (farms) in the irrigated regions of the Republic of Uzbekistan. Experiences of similar scientific researches of Russia and Kazakhstan on application of expert systems in internal organization of sites are used. Informational support of land management, especially in the areas of Uzbekistan based on artificial irrigation systems, will allow the effective use of such areas in the future. This means that relying on the methods of forming and creating a database for an irrigated area will yield positive results in the study.

## **RESULTS OF RESEARCHES AND THEIR DISCUSSION**

The creation of an automated geodesy system (CAGS) in our country is based on the use of a specialized computer system that combines a large set of technical tools for collecting, storing, processing and lighting large-scale GIS-spatial graphic and text data. It is well known that information support and information systems are elements of information technology. The economic effectiveness of information technology and the application of any information system of any land project as a whole should be an important component of its feasibility study. The three main financial methods that are used to determine the economic effect of any land use projects, such as

net present value, internal rate of return, maturity use more often than others. All these financial methods are based on the principles of discounting. The probability method, which allows you to evaluate the economic effect of a land management project based on information technology is often a statistical method (some scientists and practitioners include the statistical method in the probability method, since the potential effect is not necessarily statistically significant). The number of different information technologies and the availability of sufficient statistics allow us to draw a number of qualitative conclusions.

As a result of the restructuring of farms and the redistribution of land related to land reform in 1990–2000, the composition of arable land, the crop rotation system and the creation of agricultural enterprises in general, the system of linear design elements in arable land was lost [Volkov, 2014]. These and other reasons (the general economic situation in the country, the nature of the land and the lack of financing on land) have led to the need for an inventory of land for monitoring and maintaining inventories. Today, there is an urgent need for large-scale inter-farm and home business planning and other types of work. In order to reduce cost, quality and timely execution, it will be necessary to increase the effectiveness of the following conditions:

1. Application of the latest information technologies for full environmental monitoring and land inventory.
2. Development of a theory of land management based on planning and rational use of irrigated land.
3. Development of economic and mathematical models for the optimization of arable land, including a scientifically based crop rotation system on irrigated territory as part of on-farm land management, including an internal economic assessment of arable land.
4. Justification of theoretical and methodological guidelines for the development and practical application of automated geodesy systems for the creation and creation of irrigated and erosion-prone territories.
5. Development of an automated land management design system for the internal organization of arable land using the latest information technologies based on graphic design with elements of artificial intelligence.
6. Analysis of the possible consequences of decisions made by the expert of land management system, the development of integrated land management projects, the creation of methodological foundations for information support (database) of graphic design automation.
7. Improving the methodological approaches to modelling irrigated and erosion-prone agricultural land, taking into account automated systems for designing land management.
8. Development of the system of economic, environmental, social and other indicators of efficiency for assessing the use and protection of irrigated and erosive agricultural land.
9. Development of a methodology for calculating the economic efficiency of using automation tools.

In general, automated systems of land management projecting are a very complex system that must be created in a special modular system. Each module consists of separate blocks, which is devoted to specific issues. Usually they need to create modules for specific applications (building digital terrain models, developing the elements of internal land management projects, forecasting land use resources, etc.) and some modules (blocks) which are divided into used universal programs. This is not to say that the use of expert systems (ES), along with other tools in creating computer-aided design systems and GIS, is one of the most promising areas today. This is due, first of all, to the poorly organized design of many project tasks for land management, the expert's involvement in the decision-making process, the ability to make various districts, but no less expensive decisions, the lack of a single algorithm for solving land use problems, and the increase in indicators at each subsequent design stage. The formalization of lacks in expert systems, the lack of expert theory in land management and the lack of a methodology for their design lead to the need to update the principles and methods of developing expert systems in the design process. Academician G.S. Pospelov said that “the creation of expert systems cannot follow the usual”

client-executor “scheme. This is not so, because any expert system is filled with certain knowledge, and not such an expert system” rather, it will be in the hands of the client” [Pospelov, 2014]. The use of expert assessment methods to increase the efficiency of CADS and GIS in land management and to facilitate the communication with them, especially when analysing the data and making design decisions. This method is used to assess the likelihood of the environment as a result of land management. If any negative changes are identified, it is necessary to revise the project in order to identify positive and reasons for their elimination. The use of expert assessment should be considered as a key step towards the creation of an expert land management system that combines empirical and formal knowledge about land management processes as a key element of expert assessment.

The development of an expert system for GIS will allow more efficient processing and analysis of data. In addition, an expert system will help individuals with extensive experience in modelling and computer data processing to become qualified specialists in the use of GIS. The problem of combining spatial data from different sources can be solved by developing data models. Such models should be combined with artificial intelligence methods to reduce space exploration. This will complement the development of expert systems for GIS.

GIS is an ideal environment for using artificial intelligence methods and expert systems. This is determined by the complexity and colour of GIS data, on the one hand, and the high availability of expert systems when using GIS. In particular, today GIS has specialized expert systems that can be used to positively resolve various issues, highlight map compositions, highlight their complex elements, obtain thematic maps, and support decision making [Papaskiri, 2014]. Expert systems are a complex set of applications for symbolic computing. Therefore, to facilitate the work of such programs, various tools have been proposed that take into account both the features and the content of information in the artificial intelligence system [Papaskiri, 2014]. Cotton and grain farms operating in irrigated areas have shortcomings in internal crop management projects, such as reduced production, increased capital investment, and increased transportation costs. In particular, the analysis of the results of the internal organization of arable lands of two farms in the Turkiston settlement in Urta Chirchik district of Tashkent region revealed the following shortcomings, in which the expert systems made the following recommendations. For example, in the process of designing land management in irrigated areas, there are some shortcomings in the internal organization of crop rotation, such as a decline in production, an increase in capital and transportation costs (table 1).

An economic feasibility study should be undertaken to identify such adverse events or deficiencies in the design process. This, of course, slows down the design process. Therefore, we recommend using the aforementioned knowledge models in developing the automated system of land surveying. At the same time, the system identifies shortcomings and recommends foreseen experts. The clearer the recommendations, the higher the level of expert systems, and the more effective the outcome.

The automated system of land surveying is one of the key areas for using an expert system. Such expert systems, which are considered as practical systems of artificial intelligence, are developing in the direction of expanding their intellectual capabilities. The development of expert systems is closely connected with the increase in the level of therapeutic knowledge in them.

In our opinion, the expert system used in land management is a set of languages and software tools for using formal knowledge of land management and recording with the help of computers to solve land issues by less experienced specialists [Papaskiri, 2001]. The development and application of such a system for land management should lead to the development of new design technologies and practical decisions. At the same time, traditional set of design stages is considered as the only problem of all complexity in their interconnectedness, and the decision-making process is carried out on the basis of the correct selection and evaluation of them in an automatic mode.

Table 1. Recommendations of expert systems

The character of the disadvantages	Economic Reasons	Expert systems recommendations for elimination
<b>Place crop rotation</b>		
Incomplete size of field and area	This will increase production costs	It is necessary to optimize the size of fields and fields
Not equal in fields	Significant changes in annual crop are observed in crop rotation	It is advisable to evenly distribute the sown area
Soils scattered across fields have different quality in terms of productivity.	In crop rotation, results vary over the years	It is necessary to ensure the same quality of soil fertility
Fields on the terrain are inaccurate	As a result of washing the soil, the amount of the intended product is not taken	The long side of the fields should be horizontal
<b>Accommodation of protective forest</b>		
The tufted forests on the relief are inaccurate	As a result of improper “working” of the forest belt, the intended product was not obtained	Forest strips should be re-positioned horizontally or vertically along the slope
Thickness of forest belts is low	Due to insufficient protected area, the amount of products also decreased	It is necessary to optimize the parameters of forest belts, that is, increase the thickness
<b>Designing of field roads</b>		
Thickness and width of field paths exceeded the norm	Production output decreased due to the use of arable land	It is necessary to remove excess roads, reduce the width, and maintain the roads that cover agricultural loads
The thickness and width of field paths are well below normal, with excessive curves on the roads	There is an increase in transportation costs	It is necessary to correct the roads being designed, to optimize their parameters

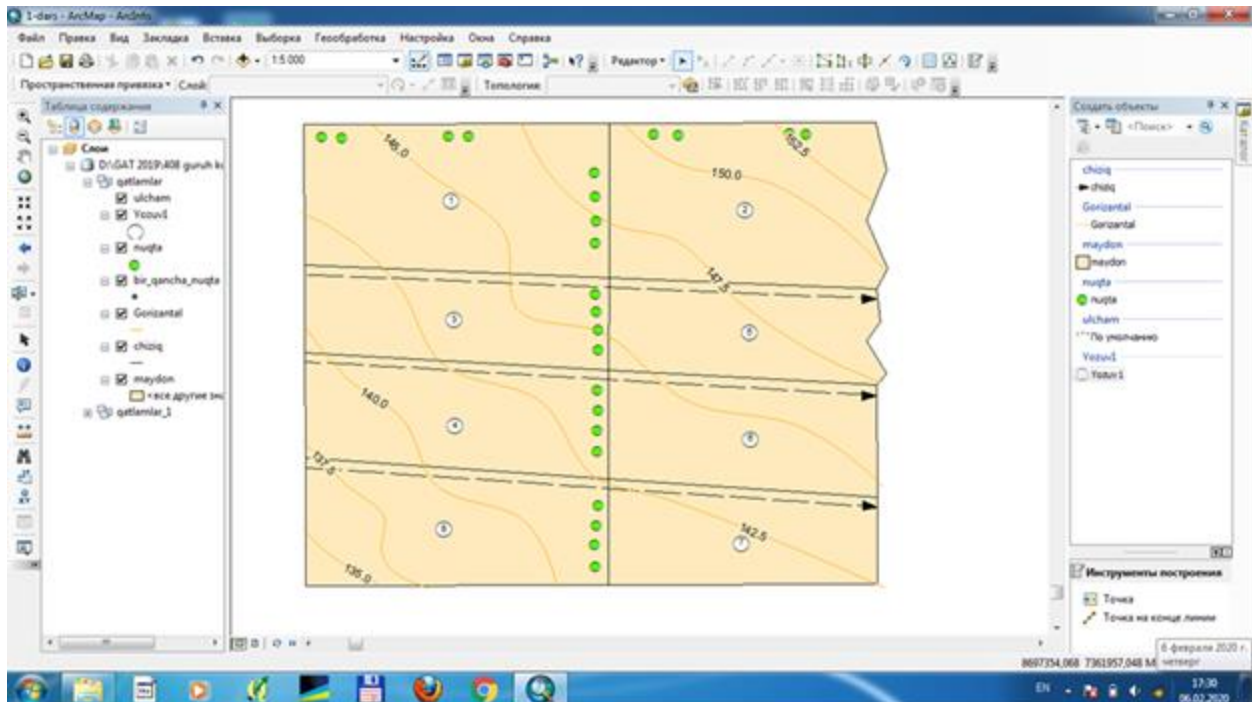


Fig. 1. The first option

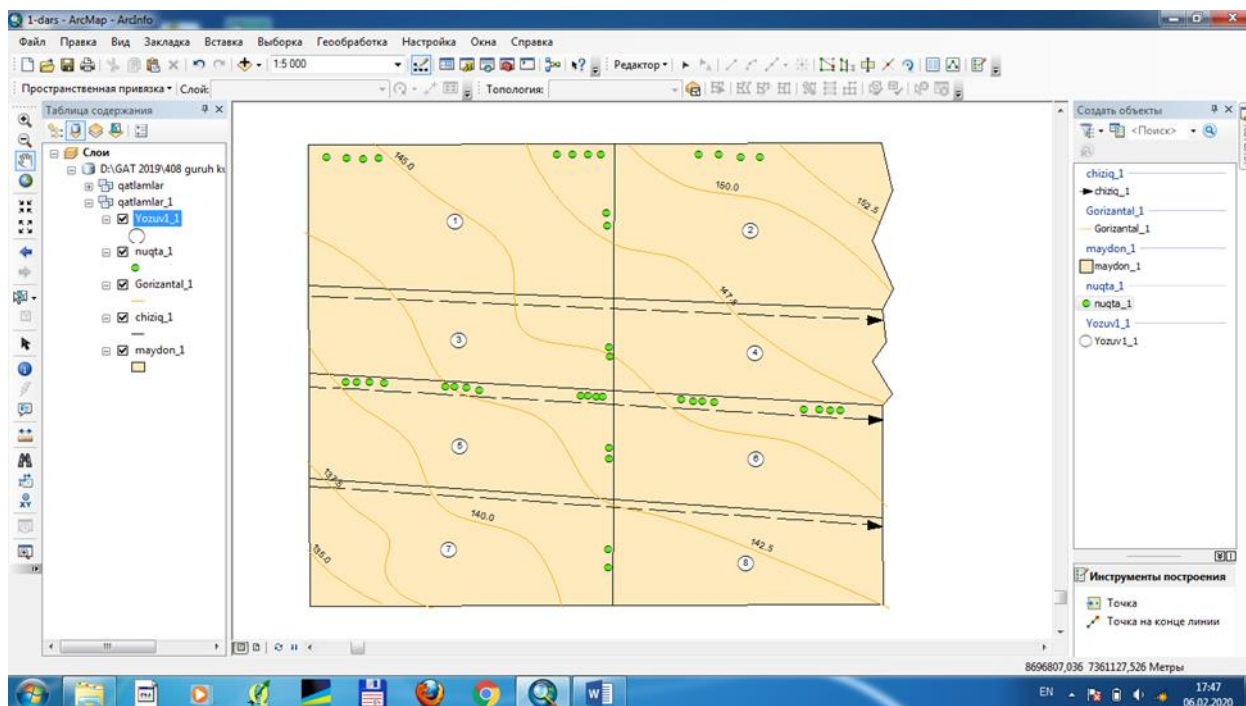


Fig. 2. The second option

Besides that, we use ArcGIS software for positioning crop fields in two variants (fig. 1, 2).

The results of the study should be considered as one of the first steps in the transition to a new land management, i.e. “digital land management” in the internal organization of agricultural land in Uzbekistan.

In particular, the project organization spent 2.1 thousand soums per hectare of arable land in the traditional way (from field observations to project approval) to develop a project for the internal organization of the above two farms, 30.4 thousand soums were spent on project.

## CONCLUSIONS

Thus, the creation of automated designing systems based on the artificial intelligence and expert systems, the use of geoinformation systems and land information systems, and the use of irrigated land in the internal organization of the use of irrigated land will reduce costs by 35.0 % compared to traditional methods used by existing project organizations in the country. At the same time, as in other developed countries, it is also known as “smart land management” will be an important step in the transition.

1. On the basis of GIS, an automated system for the development of land management projects should be available that is fully used.

2. The use of artificial intelligence and an expert system in assessing the final results of projects for irrigated regions increases its viability and expands its capabilities.

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