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Research Article

Improving The Use of Remote Sensing and Monitoring of Land in Rural Area Planning Rural Areas Based on GIS Technologies

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Abstract
In the context of the rapid growth and development of land use in rural areas worldwide, special emphasis is being placed on managing these areas in accordance with modern technologies and on the development of master plans for rural territories. At present, improving the development and organization of master plans for rural areas is considered one of the key issues in developed countries. In this regard, alongside advancing rural master plans and developing their methodologies, particular attention is also being given to the preparation of master plans as a means of improving the quality of comprehensive territorial planning and management.

Keywords: *master plan, resources, reforms, socio-economic, unmanned aerial vehicles (UAVs), land accounting, aerial imagery, cartographic materials, drones.*

INTRODUCTION

The fundamental essence of the reforms being implemented in the economy of our Republic is to improve the welfare of the population and to fundamentally enhance socio-economic conditions. Accordingly, it is essential to ensure the sustainable development of production in rural areas through structural, institutional, and investment transformations; to provide the population with favorable living and working conditions; to implement comprehensive measures aimed at expanding production enterprises through the development of master plans for territories; and to advance the rational organization of land use in rural areas. Alongside the study of factors influencing these processes, this also highlights the necessity of employing modern geographic information technologies in ensuring employment for rural and district populations and in achieving comprehensive territorial planning and organization.

In this article, particular importance is attached to improving the development of master plans for rural areas alongside the application of modern technologies, the use of international best practices, and the effective implementation of this system in accordance with national conditions. Moreover, the use of unmanned aerial vehicles (drones) in rural areas for the preparation of master plans—specifically for identifying land boundaries, assessing the current condition of land, detecting land use for non-designated purposes, and determining settlement patterns of the population—has proven to be highly effective.

Therefore, employing drones in conducting topographic surveying works for the development of master plans of rural areas in the Republic not only creates greater convenience for local specialists but also provides a reliable basis for maintaining accurate land records. In addition, it enables comprehensive observation and detailed assessment of rural territories.

In this regard, pursuant to the Resolution of the President of the Republic of Uzbekistan dated August 8, 2017, No. PQ-3182, *"On Priority Measures to Ensure the Accelerated Socio-Economic Development of Regions"*, adopted under the leadership of Shavkat Mirziyoyev, it is not without reason that specific tasks were defined to achieve high efficiency in the development of master plans for territories. These tasks include ensuring integrated regional development by

effectively taking into account the unique characteristics of each territory in the use of available land and other resources; rational allocation of land and optimal placement of facilities; systematized accounting of production, economic, social, environmental, and investment processes; and promoting regional economic development through the application of modern advanced technologies.

This indicates that, at present, insufficient attention is being paid to the comprehensive planning and organization of rural areas in our country.

In addressing the issues outlined above, the application of a scientific approach, the use of modern methods, and the modernization of the sector prove to be highly effective. Moreover, the Resolution of the President of the Republic of Uzbekistan dated September 11, 2018, No. PQ-3939, *"On Measures to Organize the Accelerated Implementation of Entrepreneurial Initiatives and Projects in the Regions"*, as well as the Resolution of the President of the Republic of Uzbekistan dated September 9, 2023, *"On Measures to Further Improve the System of State Governance in the Field of Urban Planning Activities and to Approve Programs for the Development of Urban Planning Documentation of Settlements for 2023–2027"*, adopted under the leadership of Shavkat Mirziyoyev, together with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated August 12, 2024, *"On the Development of Master Plans for Territories,"* provide a solid legal and institutional framework for advancing comprehensive territorial planning and the effective development of master plans, Furthermore, based on Resolution No. 497 of the Cabinet of Ministers of the Republic of Uzbekistan *"On the Procedure for Coordination and Approval"*, it has been stipulated as a key objective to ensure the accelerated socio-economic development of territories across the Republic, to create максимально favorable conditions for entrepreneurial activity and for attracting investments, including direct foreign investment, through the development of a set of systematic measures. At the same time, in accordance with the priority tasks and measures established by law, the development of territorial master plans is to be elevated to a qualitatively new level, while concurrently ensuring the implementation of tasks defined in other relevant regulatory and legal documents governing this field, as adopted by the Cabinet of Ministers of the Republic of Uzbekistan [1].

From this perspective, the use of modern information technologies in managing and regulating land use in rural areas serves as an effective tool for addressing the unresolved challenges in this field. The development of master plans for rural territories and their organizational and technical improvement cannot be envisioned without the application of modern technologies. In particular, contemporary GIS technologies and ArcGIS software are regarded today as among the primary tools that must be employed in this process.

Scientific research conducted for the creation of digital electronic maps of rural lands for the development of master plans for rural areas has shown that the most effective method for addressing these practical issues is the use of the ArcGIS software [2].

The stages and sequence of tasks involved in creating electronic digital maps of lands allocated to rural areas using the ArcGIS software can be explained as follows. Currently, electronic digital maps of rural lands have not been fully developed, and several challenges remain in this field. Therefore, when creating electronic maps of these territories using modern ArcGIS software, it is first necessary to study the existing condition of the selected objects and compile a comprehensive database of information about them. This is because, in the process of creating digital electronic maps of rural lands in ArcGIS, the collected data serves as the foundation for forming a structured information database. In our study, during the process of collecting data on the selected objects, their current condition and the factors influencing their development were examined. Focusing on the land areas allocated to rural territories in Ishtikhon district, it was found that a total of 7,598 hectares of land have been designated for rural use. From these figures, it can be concluded that the available opportunities for the effective use of land in rural areas are not being fully utilized [3].

This indicates the necessity of creating electronic maps to study the condition of lands in the development of master plans for rural areas, particularly using modern geographic information systems, and specifically the ArcGIS software.

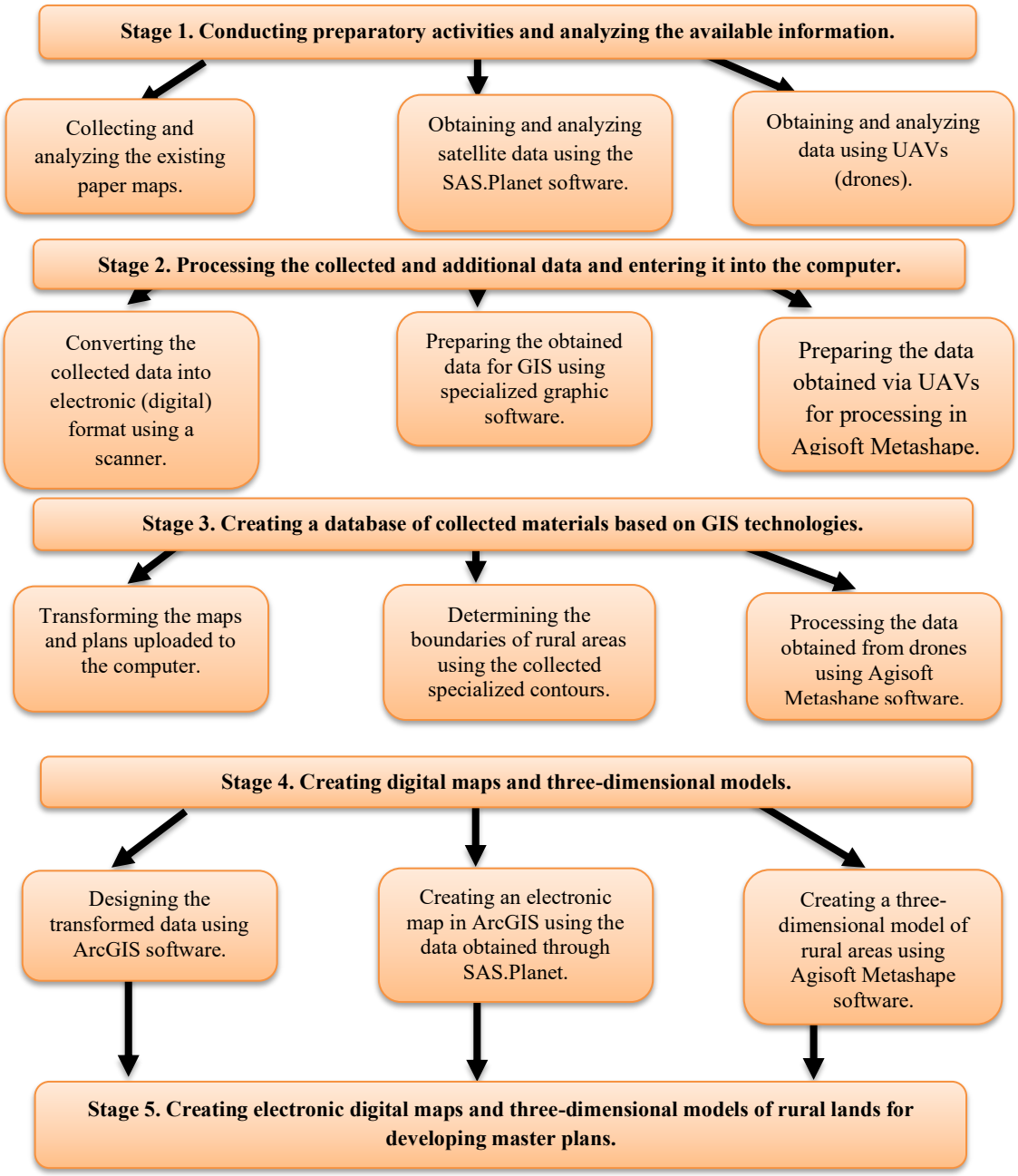

Figure 1. Stages of the technological scheme for creating electronic maps of rural lands for the purpose of developing master plans.

To achieve this, it is first essential to develop a technology for producing digital maps. In designing a specialized technological scheme for creating digital maps of rural lands based on modern geographic information systems, the key factors were analyzed, and a four-stage process was established (Figure 1).

Stage One – Data is collected on the studied territories using 1:5,000 scale topographic maps, satellite imagery of the areas, and information obtained with the help of unmanned aerial vehicles (drones).

Stage Two – The 1:5,000 scale maps of the territories are digitized using a scanner, and information on rural lands is imported into the geographic information system (GIS) using specialized graphic software. Data obtained via unmanned aerial vehicles (drones) is processed and prepared in the Agisoft Metashape software.

Stage Three – The maps and plans uploaded to the computer are transformed, the boundaries of rural lands are delineated based on contours, and the data obtained via unmanned aerial vehicles (drones) is further processed using the Agisoft Metashape software.

Stage Four – This stage represents the final phase of creating digital maps and three-dimensional models. The transformed data is further processed using the ArcGIS software, and an electronic map of rural lands is created in ArcGIS based on the information obtained through the SAS.Planeta software. Additionally, a three-dimensional model of the rural lands is generated using Agisoft Metashape to support the development of master plans.

Stage Five – Based on the work carried out in the preceding four stages, a program for assessing the condition of rural lands and the final electronic map is created.

Thus, in creating electronic maps of lands allocated to rural areas using the proposed technological scheme, the requirements of the relevant organizations and the capabilities of the end-users of these electronic maps have been duly taken into account.

Using the technological scheme developed above, an electronic map of the rural lands in Ishtikhon district, Samarkand region, was created in ArcGIS based on the subject of the study. Naturally, before creating the electronic map of the rural lands, it is necessary to determine the boundaries of the land plots in the districts using the SAS.Planeta software [4,7].

Regarding the SAS.Planeta software, it is a platform that, when connected to the Internet, allows users to download satellite images into memory according to scale (“cache”), as well as measure distances between objects.a

The convenience of the program lies in the fact that to download satellite imagery of a required area, users can select any desired scale and any size of territory, and save it in multiple file formats. Most importantly, through the program’s official website, it is possible to download an archive of satellite images of the land collected over many years and achieve high-precision results by analyzing data spanning several years.

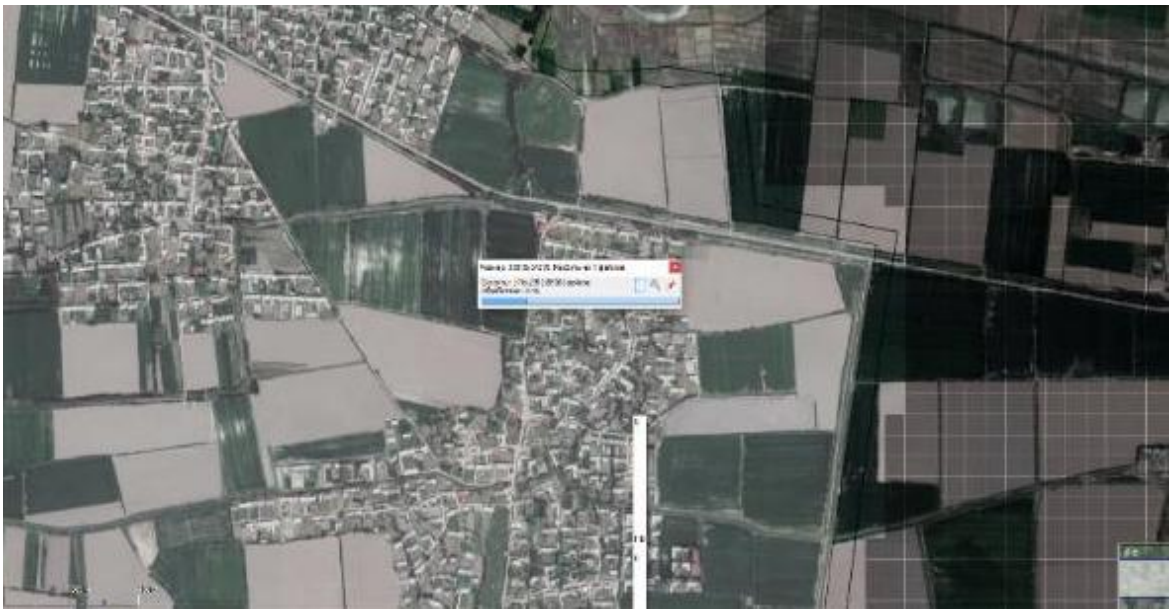

Figure 2. Downloading the territory in Ishtikhon district using the SAS. Planeta software.

Thus, the SAS.Planeta software (connected to the Internet) is launched, and the project area is selected. The territory of the land plots in Ishtikhon district, Samarkand region, downloaded using SAS.Planeta, is shown in Figure 2. As a result, after downloading the A. Berdiqulov land plot in Ishtikhon district via SAS.Planeta, it became possible to determine its boundaries, as illustrated in Figure 3.

Figure 3. Delineation of the boundaries of the A. Berdiqulov land plot in Ishtikhon district.

After delineating the boundaries of the land plots in the districts using SAS.Planeta, the data is uploaded into the modern geographic information system ArcGIS (Figure 4).

Figure 4. Delineation of the boundaries of the A. Berdiqulov land plot in Ishtikhon district.

After uploading the A. Berdiqulov land plot into the modern geographic information system ArcGIS, it becomes possible to delineate the boundaries of all lands within the plot (Figure 5).

Figure 5. Delineation of all land boundaries within the A. Berdiqulov plot in Ishtikhon district.

After delineating all land boundaries within the A. Berdiqulov plot, the boundaries of all types of allocated land areas within the plot are drawn (Figure 6).

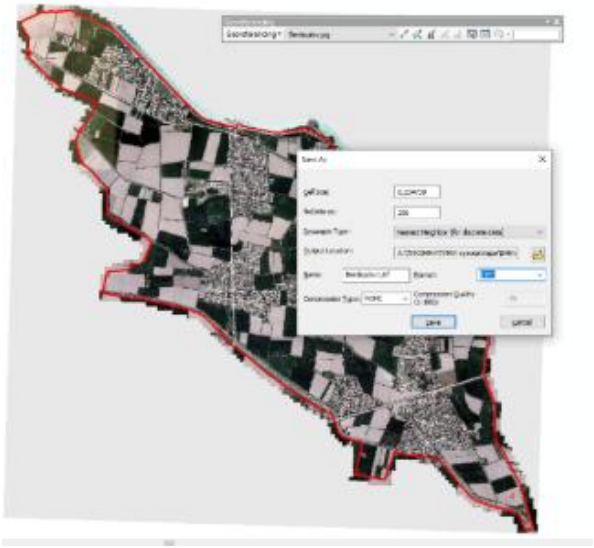

Figure 6. Drawing the land boundaries within the A. Berdiqulov plot in Ishtikhon district.

The electronic map of the A. Berdiqulov land plot in Ishtikhon district, Samarkand region, was generated as shown below (Figure 7).

Figure 7. Formation of the allocated lands within the A. Berdiqulov plot in Ishtikhon district.

The electronic map of the lands within the A. Berdiqulov plot in Ishtikhon district, Samarkand region, was created in the modern geographic information system ArcGIS as shown below (Figure 8).

Thus, in developing methodological and technical foundations for improving the application of modern technologies in the preparation of master plans for rural areas, it is recommended to practically implement the following specific measures:

First, it is necessary to create opportunities for using modern geographic information systems (GIS) and unmanned aerial vehicles (drones) in accounting for rural lands.

Second, the use of drones in rural areas has proven highly accurate for delineating land boundaries, assessing their current condition, and identifying land use for non-designated purposes.

Third, based on the results of targeted scientific research, the most convenient and efficient method for practically addressing the creation of electronic digital maps of specific rural lands is the ArcGIS software.

Fourth, the key factors in the process of creating digital maps of rural lands using modern GIS technologies were analyzed, and a specialized five-stage technological scheme was developed. Based on this five-stage scheme, an electronic map of the rural lands in Ishtikhon district, Samarkand region, was created in ArcGIS for the subject of the study.

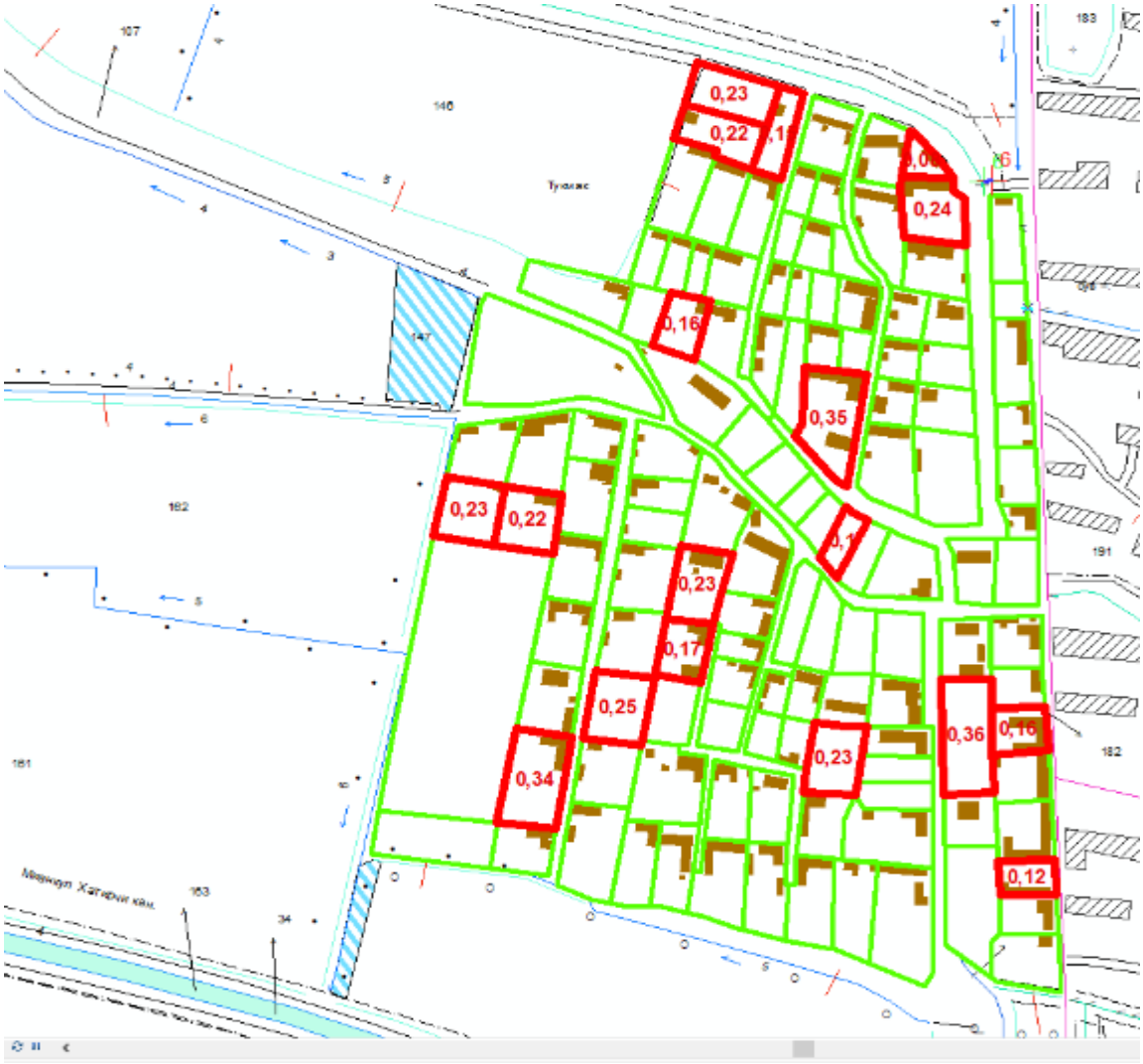

Figure 8. Electronic map of rural lands in Ishtikhon district.

Fifth, in the process of creating and managing digital maps of rural lands, the SAS.Planeta software provides extensive capabilities. When connected to the Internet, it allows satellite images to be downloaded into memory ("cache") according to scale and enables the development of a platform for measuring the boundaries of objects and the distances between them. The convenience of the program lies in the fact that, to download satellite imagery of a required area, users can select any desired scale and any size of territory, and save it in multiple file formats. Most importantly, through the program's official website, it is possible to download an archive of satellite images collected over many years and, by analyzing several years of data relevant to each rural area, create a database that reflects actual changes on the ground [5,6].

In conclusion, to determine the effectiveness of using modern geographic information systems in the development of master plans for rural areas, electronic digital maps of rural lands were created using ArcGIS software, based on data collected from unmanned aerial vehicles (drones) across the research sites. This not only allows for the direct observation

of the land plots in rural areas, but also simplifies and accelerates the processes of determining their size, topography, changes in land conditions, and the routes of canals and road networks. In addition, it provides complete access to all required information.

REFERENCES

1. Decree of the President of the Republic of Uzbekistan No. PQ-3939. (2018, September 11). *On measures to organize the accelerated implementation of entrepreneurial initiatives and projects in the regions.*
2. Altiyev, A. C., & Pardaboyev, A. P. (2020). Advantages and tasks of remote sensing of lands of dehkans and farmers. *International Journal for Innovative Research in Multidisciplinary Field*, 248–253.
3. Altiyev, A. C., & Pardaboyev, A. P. (2020, October 24). State regulation of use of agricultural lands in the Republic of Uzbekistan. *International Scientific and Practical Conference*, Moscow, 12–13.
4. Pardaboyev, A. P. (2019). Improving the monitoring of land use of dehkan and homestead farms. *Agroiqtisodiyot Journal*, (3), 88–89.
5. Rahimova, M., Pardaboyev, A., Inogamov, I., Xudoyberganov, A., Shamsiyeva, N., Tuychiyeva, I., Fathiddinova, M., Yakubov, T., & Mirjalolov, N. (2024). Most expedient mine surveying analysis and geodetic method for tracking the stability of the tailings dam position. *E3S Web of Conferences, 497*, 02027 (ICECAE 2024). https://doi.org/10.1051/e3sconf/202449702027
6. Altiyev, A. C. (2009). *Economic mechanism for liberalization of the land use system* (Monograph). Tashkent: Fan.
7. Usmanov, Y. A., & Pardaboyev, A. P. (2019). *Problems of land use of dehkan and homestead farms* (Monograph). Tashkent: TIQHMMI.

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