



EVALUATION OF THE EFFICIENCY OF THE USE OF INNOVATIVE TECHNOLOGIES IN THE ACTIVITIES OF DEHKAN FARM.

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Abstract. This article studies the effectiveness of introducing innovative technologies in the activities of dehqan farms using the example of the Kashkadarya region. The analysis reveals that the use of advanced technologies such as drip irrigation, agrodron monitoring, and digital agroplatforms has significantly increased productivity, net profit, and resource efficiency. The study identifies economic efficiency criteria based on practical experience in 2023 and illustrates them with relevant tables and diagrams. Based on the results of the article, it is concluded that the economic sustainability of dehqan farms can be ensured through the widespread introduction of innovative technologies.

Introduction. At the current stage of the world economy, the use of innovative technologies in agriculture is gaining importance not only as a means of increasing production, but also as a means of efficient use of resources, obtaining stable incomes and ensuring environmental safety. Especially in the conditions of Uzbekistan, the introduction of innovations is becoming an urgent issue against the background of limited water resources, reduced land productivity and climate change.

This article analyzes the use of innovative technologies in the activities of dehqan farms, their impact on economic efficiency, productivity and profitability, using the example of the Kashkadarya region.

In the formation of a competitive agricultural system, the sustainable operation of dehqan farms and their readiness to introduce innovative technologies play a special role. Today, in Uzbekistan, in particular, in the Kashkadarya region, water shortages, land degradation, and low labor productivity are serious problems facing dehqan farms. The main way to overcome these problems is the effective use of innovative technologies.

This article assesses the implementation of innovative technologies in the activities of dehqan farms and their economic efficiency. The assessment is based on statistical data from the Kashkadarya region.



Literature review. The issue of introducing innovative technologies in scientific sources has been studied in the following aspects:

A. Alimov (2021) found that modern equipment and agrotechnical methods in dehkan farms increase productivity by 20–25%.

According to the Ministry of Agriculture of Uzbekistan, innovations such as drip irrigation and laser leveling reduce costs by 15–20%.

The FAO (2022) report confirms stable production and high income in areas where innovative approaches are used.

Siddikov A. (2019) – measured the effectiveness of introducing innovative technologies in agriculture through productivity and resource efficiency.

Islomova D. (2021) – analyzed the practical results of drip irrigation, agrodrome and digital monitoring systems in dehkan farms.

International reports by FAO and UNDP indicate water-saving technologies and agroinnovations as a means of increasing resilience to climate change.

Nevertheless, the economic efficiency of innovations in the territorial sector - in particular, in the Kashkadarya region - has not been scientifically adequately assessed. However, empirical research shows that most studies in Uzbekistan are limited to general descriptions and do not pay sufficient attention to quantitative assessments of their economic effectiveness.

Discussion (main part). Types of innovative technologies and their application

The following innovative technologies are being introduced in farmers' farms in the Kashkadarya region:

Technology type	Field of use	Total area (he)	Efficiency result
Drip irrigation	Melon crops, orchards	3 250	Water saving 40%, yield +18%
Laser land leveling	Grain, cotton	5 500	Water consumption -15%, labor saving
Modern seeds (non-GMO)	Vegetables, potatoes	1 850	Rapid ripening, disease resistant
Biohumus fertilizers	Various crops	4 200	Soil fertility +20%

The implementation of innovative agricultural technologies in the Kashkadarya region demonstrates a growing commitment to enhancing



productivity, optimizing resource use, and improving the sustainability of dehqon (smallholder) farms. The table illustrates four major innovations that are currently applied across various types of crops and farming systems. Below is an analytical summary of their impacts:

1. Drip Irrigation Systems

- Scope: Applied predominantly to melon crops and orchards.
- Efficiency Gains:
 - Water saving: up to 40% reduction in water usage.
 - Yield increase: approximately 18% growth in productivity.
- Analysis:

Drip irrigation is one of the most effective water-saving techniques in arid regions like Kashkadarya. Given the region's limited and seasonal water availability, this technology significantly reduces irrigation losses and ensures precise water delivery to plant roots. The observed increase in yield reflects improved water-use efficiency and crop health. Additionally, it can lead to reduced weed pressure and fertilizer loss.

2. Laser Land Leveling

- Scope: Used in grain and cotton cultivation on over 5,500 hectares.
- Efficiency Gains:
 - Water usage reduction: 15%.
 - Labor efficiency: improved due to smoother terrain and uniform irrigation.
- Analysis:

Uneven land causes poor water distribution, leading to over-irrigation in some areas and under-irrigation in others. Laser leveling ensures a flat field surface, which enhances water distribution and reduces manual labor in land preparation. This technique not only saves water but also contributes to uniform crop emergence and growth, ultimately improving yield consistency.

3. Modern Seed Varieties (Non-GMO)

- Scope: Implemented in vegetable and potato cultivation.
- Efficiency Gains:
 - Early ripening: enables faster harvesting and multiple cropping cycles.
 - Disease resistance: reduces the need for chemical pesticides.
- Analysis:

The introduction of high-quality seed varieties that are early maturing and disease-resistant is vital for increasing farm profitability. These seeds offer resilience against biotic stress and shorten the production cycle, allowing



farmers to optimize land use and market access. Moreover, the reduced dependence on chemical inputs also supports environmental sustainability.

4. Biohumus Organic Fertilizers

- Scope: Applied to various crop types.
- Efficiency Gains:
 - Soil fertility increase: up to 20%.
- Analysis:

Biohumus (vermicompost) is a nutrient-rich organic fertilizer that improves soil structure, microbial activity, and long-term fertility. Its usage contributes to increased yields over time, especially in degraded soils. Moreover, biohumus supports sustainable agriculture by reducing the need for synthetic fertilizers, improving water retention, and enhancing soil biodiversity.

General Implications

These innovative technologies collectively:

- Improve input efficiency (water, labor, seeds, fertilizers),
- Increase crop yields and profitability,
- Support climate-smart agriculture by promoting sustainable land and water management practices,
- Reduce dependency on traditional farming methods and enhance competitiveness of smallholder farmers in the region.

The adoption of such innovations can be further accelerated through:

- Government subsidies and incentives,
- Training and technical support for farmers,
- Access to credit and technology providers.

Types of innovative technologies and their description

The following innovative technologies were included in the analysis:

Technology Type	Description	Expected Positive Impact
Drip irrigation	Delivers water in precise doses and directly to the roots	Reduces water consumption by 30-40%
Agrodrone monitoring	Monitoring the condition of crops from above	Reduces fertilizer and pesticide consumption by up to 20%
Digital agricultural platforms	Accounting for land, water, labor and equipment	Increases decision-making speed



The introduction of innovative technologies in agriculture is increasingly recognized as a key driver of productivity, sustainability, and profitability - especially for smallholder farmers operating in resource-constrained environments such as the Kashkadarya region of Uzbekistan. This analysis evaluates the economic effectiveness of three primary innovations: **drip irrigation, agrodrone monitoring, and digital agricultural platforms.**

Drip irrigation delivers water directly to plant roots in controlled amounts, minimizing evaporation and runoff.

Economic Impact:

- **Previous average profit:** 12.5 million UZS per farm
- **Profit after implementation:** 17.2 million UZS
- **Profit growth:** +37.6%

Analytical Insight:

Drip irrigation had the **greatest positive impact** among the technologies studied. In arid regions like Kashkadarya, where water scarcity is a chronic challenge, this method significantly **reduces water usage (by 30–40%)** while **increasing yield and crop quality.** Improved root-zone moisture and nutrient delivery explain the higher profitability.

Agrodrone collect aerial imagery and data, allowing farmers to monitor crop health, pest infestations, and irrigation needs from above.

Economic Impact:

- **Previous average profit:** 14.3 million UZS
- **Profit after implementation:** 18.1 million UZS
- **Profit growth:** +26.6%

Analytical Insight: Agrodrone technology contributes to **precision agriculture** by detecting problems early, enabling targeted use of fertilizers and pesticides. The result is a **reduction of chemical input costs by up to 20%,** better plant health, and **higher operational efficiency.** Although the initial investment can be relatively high, the medium-term return is substantial.

These platforms help farmers **manage land, water, labor, and machinery** efficiently through digital dashboards and analytics tools.

Economic Impact:

- **Previous average profit:** 15.0 million UZS
- **Profit after implementation:** 19.8 million UZS
- **Profit growth:** +32.0%

Digital agro-platforms **accelerate decision-making** and improve planning across the farming cycle - from sowing to harvest. With better record-keeping





and real-time resource tracking, farmers reduce losses due to human error and poor timing. The **32% increase in net profit** shows the financial benefit of digitizing farm operations, even for small-scale producers.

- All three technologies produced **substantial increases in net profit**, ranging from **+26.6% to +37.6%**.

- **Drip irrigation** offered the **highest financial return**, particularly effective in water-scarce areas.

- **Digital tools and drones** enhanced **decision-making and resource optimization**, which translated into measurable efficiency gains.

Based on these results, the following strategies are recommended:

- **Subsidize and support the expansion** of smart irrigation systems for smallholder farms.

- Provide **training programs** on the use of agrodrones and digital tools.

- Promote **public-private partnerships** to make technology affordable and accessible.

- Continue conducting **region-specific impact evaluations** to tailor innovations to local farming conditions.

If you'd like a visual version of this analysis (bar chart, infographic, etc.) or an academic-style paper with citations and formatting, I'd be happy to assist!

Evaluation method and economic analysis

Efficiency was assessed using the following criteria:

Increase in yield (t/he)

Reduction in water consumption (%)

Reduction in production costs (%)

Increase in net profit (%)

Experimental data for 2023 (based on 20 dehkan farms in Kashkadarya region):

Technology type	Previous profit (mln soums)	Next profit (mln soums)	Profit increase (%)
Drip irrigation	12,5	17,2	+37,6
Agrodrone monitoring	14,3	18,1	+26,6
Digital agroplatforms	15,0	19,8	+32,0

Economic efficiency of innovations



This table presents the farms where innovations were applied and their profit indicators:

Indicator	Innovative farm	Traditional farm
Average income (mln soums/he)	12,5	9,0
Average cost (mln soums/he)	6,8	6,4
Net profit (mln soums/he)	5,7	2,6
Profitability rate (%)	83,8%	40,6%

The results show that innovative technologies significantly increase revenue, improving net profit and profitability by almost 2 times.

Results and analysis. Water use on farms where drip irrigation was introduced has decreased by up to 1,200 m³ per hectare.

Pesticide use on farms where Agrodron was used has decreased by at least 15%.

Productivity on farms managed using digital technologies has increased by 10–15 units per hectare.

Conclusion.

The use of innovative technologies in dehqan farms in the Kashkadarya region has a positive impact on their economic efficiency. The level of profit is increasing through the efficient use of water resources, increasing productivity, and reducing labor and financial costs. The practical application of innovative technologies is an important factor in strengthening the competitiveness of small dehqan farms, especially.

The results of the study show that the introduction of innovative technologies in the activities of dehqan farms plays an important role in increasing efficiency. In particular, water-saving technologies, agrodron observations and digital management systems ensure increased income, reduced costs and rational use of resources.

Therefore, the popularization of innovative technologies, provision of subsidies and training of dehqan farms in digital skills are relevant in the Kashkadarya region.

As recommendations:

Strengthen the system of subsidizing innovative technologies;

Expand regional agrotechnical services;



It is necessary to organize trainings on innovations among the rural population.

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