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DEVELOPING ECONOMIC MECHANISMS FOR EFFICIENT USE OF WATER RESOURCES IN AGRICULTURE

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Abstract

This thesis examines the economic mechanisms required to ensure efficient use of water resources in agriculture. The purpose of the study is to assess the current state of agricultural water use efficiency and to substantiate a set of economic incentive mechanisms capable of accelerating the adoption of water-saving practices. The research relies on comparative analysis, statistical analysis and a systemic approach, drawing on official statistics, FAO AQUASTAT data, and international scientific literature. The findings show that although agriculture accounts for roughly 90–92% of total freshwater withdrawal in Uzbekistan, water productivity remains low, and that a combination of targeted subsidies, preferential credit, differentiated water tariffs and strengthened water user associations is required to close this gap.

Keywords: Agricultural water use, water productivity, economic mechanisms, water pricing, water-saving technologies, water user associations, sustainable agriculture, green economy.

INTRODUCTION

Agriculture is the largest consumer of freshwater resources worldwide, and this dependency is particularly pronounced in arid and semi-arid countries of Central Asia. In Uzbekistan, agriculture accounts for approximately 90–92% of total water withdrawal, averaging around 56 billion cubic meters per year, which represents roughly 60% of all water use across the Central Asian region. At the same time, irrigation infrastructure efficiency stands at only 53–58%, implying a potential water saving of 11–14 km3 per year if best available practices were adopted. Annual per-capita freshwater availability

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is estimated at only 531 m3, placing the country among those facing severe water stress; international projections suggest Uzbekistan could rank 29th among the world's most water-stressed countries by 2040. Against this background, the Development Strategy of New Uzbekistan for 2022–2026 (Presidential Decree PF-60, 28 January 2022) and the "Uzbekistan – 2030" Strategy (Presidential Decree PF-158, 11 September 2023) set out ambitious targets, including raising water use efficiency by 25% and saving up to 15 billion cubic meters of water within five years. Achieving these targets requires not only technological modernization but, more importantly, well-designed economic mechanisms capable of making water-saving investments financially attractive to farmers. The purpose of this thesis is to identify and substantiate the economic mechanisms most likely to accelerate efficient water use in Uzbekistan's agricultural sector.

MAIN PART

Empirical evidence indicates that drip irrigation technologies can reduce water consumption by 30–50% compared to traditional furrow irrigation while increasing crop yields by 20–40%, depending on crop type and local conditions. Table 1 and Figure 1 summarize comparative water-use norms and yield effects across the main irrigation methods used in Uzbekistan's cotton sector.

Table 1. Water use norms and economic-agrotechnical indicators by irrigation method (cotton, illustrative estimates)

Irrigation method	Water use norm, m3/ha	Water saving vs. traditional, %	Yield change, %	Initial investment, mln UZS/ha
Traditional (furrow) irrigation	11,500	-	0 (baseline)	0
Sprinkler irrigation	7,800	32.2	+15	18-22
Drip irrigation	5,750	50.0	+32	25-30
Subsurface irrigation	6,200	46.1	+22	30-35

As Table 1 shows, drip irrigation delivers the highest water saving (50.0%) and yield gain (+32%) among the compared methods, but also requires the largest upfront investment (25–30 million UZS/ha).

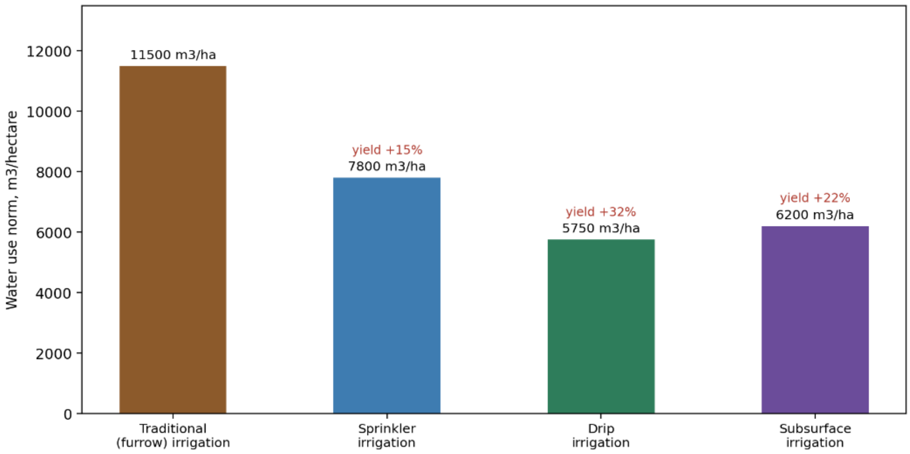

Figure 1. Water use norms and yield change by irrigation method (cotton, illustrative estimates)

However, equipping one hectare with drip irrigation costs approximately 25 million UZS (about USD 2,200), and government subsidies typically cover only a third to a half of this expense, leaving a substantial financial burden on individual farmers, especially smallholders. This cost barrier is repeatedly identified in the literature as the principal constraint on the wider adoption of water-saving irrigation technologies, alongside high maintenance costs and limited technical suitability for local soil and climate conditions.

International experience demonstrates several complementary economic instruments that can address this constraint. First, targeted capital subsidies and tax or customs exemptions reduce the effective cost of water-saving equipment; in Uzbekistan, farmers adopting such systems are already exempted from land tax for five years, and subsidy coverage could reasonably be raised toward 50–60% for smallholders. Second, agricultural leasing ("agrolizing") schemes allow the upfront investment burden to be spread over time, improving cash-flow feasibility for farms with limited access to formal credit. Third, water pricing reform — in particular, volumetric or tiered water tariffs that charge progressively higher rates for water use above an established norm — has been shown, in the case of China's agricultural water pricing reform, to strengthen incentives for water conservation and to encourage a shift toward higher-value, less waterintensive crops, although such reforms depend heavily on functioning measurement infrastructure and farmers' price responsiveness. Fourth, strengthening Water User Associations (WUAs) and extension/advisory services improves the governance of water allocation at the farm and canal level and supports the diffusion of best practice through demonstration plots. Fifth, blended finance mechanisms — combining public–private partnerships with green finance instruments such as green bonds and international climate funds — can help mobilize the capital needed to modernize aging irrigation infrastructure, whose poor condition currently accounts for a large share of conveyance losses.

Cost-benefit estimates illustrate the potential of these mechanisms (Table 2). For high value-added crops such as vineyards, orchards and vegetables, the payback period on farmer-borne investment (after subsidy) in drip irrigation is estimated at around one year, with a benefit-cost ratio over a five-year horizon in the range of 4.5–5.1. For state-regulated crops such as cotton, the payback period is longer, at roughly two years, but the investment nonetheless remains economically justified.

Table 2. Cost-benefit indicators of drip irrigation by crop type (illustrative estimates)

Crop type	Investment, mln UZS/ha	Government subsidy, %	Farmer's cost, mln UZS/ha	Annual net benefit, mln UZS/ha	Payback period, years	Benefit-cost ratio (5 yrs)
Cotton	25.0	40	15.0	7.0	2.1	2.33
Vineyard / orchard	30.0	35	19.5	17.5	1.1	4.49
Vegetables	20.0	45	11.0	11.2	1.0	5.09

These findings suggest that economic mechanisms should be differentiated by crop profitability: incentive-based scaling for high-value crops in the near term, complemented by a gradual increase in subsidy rates for strategic crops to broaden overall coverage. As of the mid-2020s, water-saving technologies had been introduced on roughly a quarter of Uzbekistan's approximately 3.5 million hectares of irrigated cropland, indicating substantial remaining potential for expansion.

CONCLUSION AND RECOMMENDATIONS

The analysis confirms that the economically efficient use of water resources in agriculture cannot be achieved through market forces or technology alone; it requires a coherent set of economic mechanisms operating together. Based on the findings, the following recommendations are proposed: (1) increase capital subsidy rates for water-saving irrigation equipment to 50–60% for smallholder farms; (2) expand agricultural leasing schemes for irrigation equipment to ease upfront financing constraints; (3) introduce a differentiated, volumetric water tariff structure that rewards water conservation and penalizes excessive use above established norms; (4) strengthen Water User Associations and agricultural extension services, supported by an expanded network of demonstration plots; (5) mobilize public–private partnerships and green financing instruments to modernize irrigation and drainage infrastructure; and (6) integrate water productivity indicators into regional and sectoral development performance targets. The coordinated implementation of these mechanisms would support Uzbekistan's stated objective of increasing water use efficiency by 25% and saving up to 15 billion cubic meters of water over the coming five years, while contributing to the broader Sustainable Development Goal of ensuring efficient water use across all sectors of the economy.

REFERENCES

[1.] Decree of the President of the Republic of Uzbekistan No. PF-60, "On the Development Strategy of New Uzbekistan for 2022–2026", dated 28 January 2022.

[2.] Decree of the President of the Republic of Uzbekistan No. PF-158, "On the 'Uzbekistan – 2030' Strategy", dated 11 September 2023.

[3.] Hamidov A., Akramkhanov A., Khamidov M., Juraev U., Abulkosimova Sh., Helming K. Technological and policy challenges in implementing water-saving irrigation technologies: a case study from Uzbekistan // International Journal of Water Resources Development. – URL: https://www.tandfonline.com/doi/full/10.1080/07900627.2025.2612485

[4.] Bekchanov M., Ringler C., Bhaduri A., Jeuland M. Income and irrigation water use efficiency under climate change: An application of spatial stochastic crop and water allocation model to Western Uzbekistan // ScienceDirect. – 2016. – URL: https://www.sciencedirect.com/science/article/pii/S2212096316300122

[5.] Financial/economic incentives to support water savings and water productivity improvements in Uzbekistan // International Water Management Institute (IWMI), Water, Land and Ecosystems. – URL: https://archive.iwmi.org/wle/financial-economic-incentives-support-water-savings-and-water-productivity-improvements-uzbekistan/

[6.] Irrigation innovation: Navigating challenges in Uzbekistan's water–energy–food–environment nexus // CGIAR. – URL: https://www.cgiar.org/news-events/news/irrigation-innovation-navigating-challenges-in-uzbekistan-water-energy-food-environment-nexus

[7.] Strengthening the Economic, Financial and Technological Dimensions of Water Efficiency in Uzbekistan. – Paris: OECD Publishing, 2023.

[8.] Water pricing reform for sustainable water resources management in China's agricultural sector // ScienceDirect. – 2022. – URL: https://www.sciencedirect.com/science/article/pii/S0378377422005923

[9.] FAO AQUASTAT Database: Uzbekistan Country Profile // Food and Agriculture Organization of the United Nations. – URL: https://www.fao.org/aquastat

[10.] Uzbekistan aims to increase water use efficiency by 25% over five years — president // Gazeta.uz. – 2024. – URL: https://www.gazeta.uz/en/2024/09/27/water/