

THE EVOLUTION OF ECONOMIC MECHANISMS FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT IN UZBEKISTAN: A MULTI-DIMENSIONAL ANALYSIS OF POLICY, FINANCE, AND INNOVATION

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Abstract: Uzbekistan is currently implementing the Strategy for Agricultural Development 2020–2030 to transition its agrarian sector toward a market-oriented, sustainable model. This transformation seeks to address severe ecological constraints, including the Aral Sea crisis and escalating soil salinity, by integrating independent producers into a vertically structured agro-cluster system. A range of new economic mechanisms has been introduced to incentivize sustainability, most notably the “Better discipline – cheaper credit” rating system and the proactive digitization of state support via the Agrosubsidy platform. Furthermore, the scaling of water-saving irrigation technologies—such as drip and sprinkler systems—and the institutionalization of long-term land lease rights by 2027 are designed to improve resource efficiency and financial predictability for farmers. The growth of green financing also provides critical pathways for funding climate-resilient and energy-efficient agricultural modernization.

Keywords: Sustainable agriculture, Uzbekistan, agro-clusters, green finance, water-saving technologies, digitalization.

The agricultural sector in Uzbekistan is currently navigating a period of profound structural transformation, transitioning from a centrally planned economy characterized by state mandates to a market-oriented system grounded in sustainability and competitive integration. This evolution is formally encapsulated in the Strategy for Agricultural Development 2020–2030, a comprehensive policy framework designed to foster environmental resilience, economic profitability, and social equity.¹ Improving economic mechanisms in this context requires a nuanced understanding of risk-oriented credit models, digitalized subsidy systems, and the integrated value chains provided by the emerging agro-cluster system.

Conceptualizing Sustainability Through Global and Regional Indicators

To improve the economic mechanisms of farm sustainability, it is necessary to establish a robust metric for evaluation. Sustainability in agriculture is fundamentally a multi-dimensional concept, often segmented into environmental, economic, and social pillars. A systematic review of global agricultural sustainability indicators reveals a set of 101 core metrics, yet emphasizes that these indicators must be frequently updated to reflect regional constraints and technological advancements.

The Systematic Evaluation of Farm Sustainability

The search for a universal indicator system has led to the adoption of methodologies like the SALSA (Search, Appraisal, Synthesis, and Analysis) framework and the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement. These tools allow researchers to categorize indicators based on their micro, meso, and macro-level impacts. For the Uzbek context, the micro-level focuses on farm-gate prices and field-level soil fertility, while the macro-level involves global trade integration and national food security policies.

¹ Agriculture - Invest Uzbekistan, <https://invest.gov.uz/en/guide/explore/4>

A census-based methodology proposed for evaluating agricultural holdings identifies five strategic dimensions: innovation, organic farming practices, crop diversification, economic size (measured by Standard Output), and multifunctionality. This methodology is particularly useful for Uzbekistan, where traditional surveys often miss the smallest agricultural units, such as Dehkan farms, which are critical for domestic food security but frequently operate with a yearly standard output below the thresholds used by major international accountancy networks.

Sustainability Dimension	Strategic Farm Feature	Uzbekistan Contextual Application
Economic	Standard Output (SO)	Proxy for farm revenue; distinguishes commercial farms from subsistence Dehkans.
Environmental	Organic/Biodynamic Farming	Reducing chemical inputs; managing salinity in the Aral Sea basin.
Social	Multifunctionality	Agritourism and social farming as secondary income for rural households.
Managerial	Innovation/Modernization	Adoption of precision agriculture and automated management systems.
Operational	Diversification	Greening requirements; multi-crop systems to replace mono-cropping.

Table 1: Sustainability dimensions and their application to Uzbek agricultural holdings.

The Aral Sea Crisis and the Economic Imperative for Environmental Action

The environmental sustainability of Uzbek farms is intrinsically linked to the status of the Aral Sea. Since the second half of the 20th century, the intensive diversion of the Amu Darya and Syr Darya rivers for cotton irrigation led to the creation of the Aralkum Desert, a dry seabed area exceeding 5.5 million hectares. This environmental transformation has introduced severe economic externalities, including salt and dust storms that degrade soil fertility in the surrounding Kashkadarya, Surkhandarya, and Bukhara regions.

The Cost of Soil Salinity and Water Depletion

The economic mechanism for addressing soil salinity involves both direct investment and the adoption of alternative crops. Soil degradation currently poses a significant risk to the financial outlays of farms, as the cost of land washing and the maintenance of saline-affected land increases production overheads. Innovative solutions being implemented include the planting of more than 1 million hectares of saxaul and other salt-tolerant vegetation to stabilize the Aralkum Desert.²

From an economic perspective, the shift toward "green" rehabilitation in the Republic of Karakalpakstan, supported by international funding from organizations like the Korean

² Kh.Khujamkulova,A.Muxsiddinov.pdf [View of Problems and Innovative Solutions in Agriculture Caused by Global Climate Change](#)

International Cooperation Agency (KOICA), represents a transition toward sustainable land management that integrates ecological stabilization with rural livelihood support. The economic efficiency of these interventions is measured by the reduction in salt-drift damage to agricultural crops and the preservation of remaining water resources.

Water-Saving Irrigation Technologies (WSIT) as an Economic Lever

Uzbekistan’s agriculture is almost entirely dependent on irrigation, accounting for 92% of total water withdrawal. The economic value created from one cubic meter of water in Uzbekistan is estimated at only $2.6/m^3$, significantly lower than in other arid regions. To improve this, the government’s 2020–2030 Strategy aims to equip 2 million hectares—approximately 50% of all irrigated land—with WSIT by 2030.

Drip and sprinkler irrigation technologies offer a dual economic benefit: they reduce water consumption by 40-50% and increase yields by up to 20-30% by delivering nutrients directly to the root zone. However, the initial capital requirement remains a barrier, with installation costs ranging from \$1,200 to \$1,500 per hectare. To mitigate this, the state provides subsidies covering 50% of the cost, complemented by low-interest, 10-year loans from local banks.

Irrigation Technology	Water Savings (%)	Yield Increase (%)	Cost per Hectare (USD)	State Support
Drip Irrigation	40-50%	18-20%	\$1,200 - \$1,500	50% Subsidy + Low-interest loans.
Sprinkler Irrigation	30-40%	15-18%	\$1,000 - \$1,300	Targeted regional subsidies.
Traditional Furrow	0% (Base)	0% (Base)	Minimal	Phased out through incentive programs.

Table 2: Economic comparison of irrigation technologies in Uzbekistan.³

Cotton-Textile Clusters: From Raw Export to Apparel

Historically, Uzbekistan exported raw cotton fiber, which left the domestic economy vulnerable to global price fluctuations. The cluster model has successfully reoriented the sector toward deep processing. By 2024, the textile industry employed 600,000 people, up from 188,000 in 2018, and the country achieved the capacity to convert 100% of raw cotton into yarn domestically.

This transition to higher value-added apparel production has been supported by the elimination of systemic forced labor and child labor, a reform verified by the International Labor Organization (ILO) in 2022. The resulting end of the international boycott of Uzbek cotton has opened access to premium Western markets, further stabilizing the financial outlook for cotton clusters.⁴

Economic Challenges and Monopsony Risks

³ Full article: Technological and policy challenges in implementing water-saving irrigation technologies: a case study from Uzbekistan - Taylor & Francis, <https://www.tandfonline.com/doi/full/10.1080/07900627.2025.2612485>

⁴ Weaving a New Future in Uzbekistan's Cotton Sector - World Bank, <https://www.worldbank.org/en/news/feature/2025/05/27/weaving-a-new-future-in-uzbekistan-s-cotton-sector>

Despite the success of clusters in modernization and job creation, the system has introduced new economic risks. Many farmers report being locked into "private monopsonies" where they have no alternative marketing channels for their raw cotton and wheat. In recent years, payment delays by clusters have caused financial strain for producers, leading to debt and, in some cases, bankruptcy. By early 2025, several cotton clusters were themselves facing bankruptcy due to high debt loads and water shortages.

To improve the economic mechanism of the cluster model, the government has begun aligning domestic cotton prices with Intercontinental Exchange (ICE) averages, allowing for contracts based on futures, forwards, and spot transactions. This move toward market-based pricing is intended to protect farmers' interests and ensure that the financial risks are shared more equitably across the value chain.⁵

Cluster Type	Operational Units (2022)	Investment Growth (2022-2023)	Key Export Drivers	Economic Concerns
Cotton-Textile	509 (Structure total)	73.5% Surge	Yarn, high-value apparel	Monopsony power, payment delays.
Fruit & Vegetable	Expanding	Moderate	Fresh/Processed fruits, nuts	Logistics infrastructure, certification.
Grain	Core Sector	Stable	Domestic food security, flour	Soil erosion, irrigation efficiency.
Livestock	Emerging	Variable	Eggs, poultry meat	Feed costs, pasture degradation.

Table 3: Sectoral performance and economic dynamics of agro-clusters.

The "Better Discipline – Cheaper Credit" Model

In late 2025, President Shavkat Mirziyoyev introduced a new credit rating system aimed at rewarding financially responsible borrowers. Under the "Better discipline – cheaper credit" model:

- **Farms with an "A" rating:** Receive a 2 percentage point reduction in interest rates.
- **Farms with a "B" rating:** Receive a 1 percentage point reduction.

This mechanism moves away from the uniform interest rate system that previously existed, creating a tangible economic incentive for farms to maintain accurate financial records and repay preferential loans early. In 2024, approximately 9,002 farms repaid loans ahead of schedule, totaling 2.5 trillion UZS, which allowed the government to reallocate funds toward agrotechnical modernization.⁶

⁵ Report Name: Cotton and Products Annual - USDA/FAS, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Cotton+and+Products+Annual_Tashkent_Uzbekistan+-+Republic+of_UZ2025-0001.pdf

⁶ President Presented with Reform of Agricultural Subsidies and ..., <https://www.uzdaily.uz/en/president-presented-with-reform-of-agricultural-subsidies-and-credit-system/>

The Role of Green Financing and Risk Insurance

Green financing has emerged as a critical tool for aligning investment flows with environmental goals. Between 2015 and 2024, green-oriented investments in Uzbekistan’s agricultural sector grew at an average annual rate of 17.9%, significantly outpacing the general growth in agricultural credit. However, the sector remains heavily reliant on concessional green loans, which account for 52.4% of total green finance flows.⁷

To further de-risk the sector, the government is introducing agricultural risk insurance. Legislative measures passed in November and December 2025 establish the "Agricultural Risk Insurance System," which aims to protect farms from climatic and water-related disasters. This system is integrated with the credit process, allowing insurance policies to serve as a form of "movable asset" collateral, thereby improving access to capital for smallholders who lack substantial real estate

Digitalization and Technological Innovation

The digitalization of the agri-food sector is a cornerstone of the Strategy for Agricultural Development 2020–2030. Automated management systems, remote sensing, and blockchain-based subsidy platforms are being deployed to reduce transaction costs and improve resource allocation.

The "Agroportal" and Proactive Subsidization

The establishment of the Agency for Payments in the Agricultural Sector has led to a significant simplification of the state support system. Uzbekistan currently maintains 52 different types of agricultural subsidies, many of which were historically difficult for farmers to access due to bureaucratic hurdles.⁷ The new digital platform, "Agrosubsidy," integrates data from ten ministries to provide subsidies proactively. In 2026, the government plans to provide 1.3 trillion UZS in proactive subsidies without requiring individual applications, thereby reducing the "human factor" and potential for corruption.

Precision Agriculture and Economic ROI

The adoption of precision farming—utilizing GPS, IoT sensors, and drone imaging—has demonstrated high returns on investment (ROI). Pilot projects in the Fergana Valley and Samarkand regions show that digital decision-making can reduce production costs by 20-30% and increase yields by up to 35%. Drone-based imaging alone has been shown to reduce manual inspection labor by 60%, while sensor-controlled irrigation systems can achieve cost savings of 18% per hectare with a payback period of only 2 to 3 years.⁸

Innovation Category	Technology Used	Economic Impact	Payback Period
Digital Irrigation	Soil moisture sensors, automated valves	35% water reduction, 28% yield increase.	2-3 Years
Precision	Drones, GPS, AI yield	15% reduction in chemical	4-5 Years

⁷Green Financing Mechanisms in Uzbekistan's Agricultural Sector for Sustainable Development - ASPG, <https://americaspg.com/public/article/download/4228>

⁸ ECONOMIC EFFICIENCY OF DIGITAL TECHNOLOGY ADOPTION IN UZBEKISTAN'S AGRICULTURAL SECTOR - Innovative Academy, <https://in-academy.uz/index.php/si/article/download/62405/39260/69900>

Farming	mapping	use.	
Logistics/Trade	E-commerce, mobile market apps	20% higher profitability via direct market access.	N/A
Fin-tech	"Agrosubsidy" proactive platform	Significant reduction in bureaucratic overhead.	Instant

Table 4: Digital innovation and its economic impact on Uzbek farms.

OECD and WTO Integration

As Uzbekistan moves toward WTO accession, it must harmonize its agricultural policies with global standards. This involves reducing statutory restrictions on Foreign Direct Investment (FDI) and improving the transparency of investment rules. The OECD recommends that Uzbekistan clarify foreign investor access to agricultural land and reduce the reliance on secondary legislation for substantive investment regulation. By adopting a "negative list" approach to FDI and implementing Regulatory Impact Assessments (RIA), Uzbekistan can create a more predictable and stable business environment for international agribusinesses.⁹

Synthesis of Findings and Future Outlook

The analysis of economic mechanisms to ensure farm sustainability in Uzbekistan reveals a sector at a decisive crossroads. The transition from a command economy to a market-based cluster system has yielded impressive results in industrialization and job creation, but it has also exposed vulnerabilities in the relationship between clusters and independent producers. Improving sustainability requires a continued focus on three pillars:

1. **Financial Resilience:** The integration of "Better discipline – cheaper credit" models with comprehensive agricultural risk insurance will be vital for protecting farms from the increasing frequency of climatic shocks.
2. **Technological Efficiency:** The massive scaling of water-saving irrigation and digital monitoring platforms is the only viable pathway to maintaining productivity in a water-scarce environment. The government's proactive subsidy system must continue to target these technologies to ensure high adoption rates among smallholders.
3. **Institutional Transparency:** The successful completion of the land lease reforms by 2027 will be the bedrock of long-term sustainability. Secure, collateralizable land rights provide the ultimate incentive for farmers to invest in sustainable land management and value-added infrastructure.

As Uzbekistan continues its "Green Industrial Revolution," the synergy between innovative policy, targeted finance, and international cooperation will determine the future of the nation's agri-food sector. The 2020–2030 Strategy provides the necessary vision, but its success will hinge on the effective implementation of these refined economic mechanisms at the farm level.¹⁰ By aligning domestic incentives with global market realities and environmental constraints, Uzbekistan can

⁹Assessment and recommendations: Roadmap for Sustainable Investment Policy Reforms in Uzbekistan | OECD, https://www.oecd.org/en/publications/roadmap-for-sustainable-investment-policy-reforms-in-uzbekistan_20865f29-en/full-report/assessment-and-recommendations_11cf7850.html

¹⁰ The State of the Agri-, Food-, and Climate-Tech Innovation Ecosystem in Uzbekistan | Country Report | June 2025 - CGSpace, <https://cgspace.cgiar.org/bitstreams/64a3df7f-35ef-4370-9f2e-f837b2afbbd9/download>

ensure that its agricultural sector remains a pillar of regional stability and prosperity for the next generation.

Conclusion

This review demonstrates that the sustainability of farms in Uzbekistan is transitioning from a policy concept to a measurable economic reality. The historical reliance on extensive cotton cultivation and state quotas is being replaced by a sophisticated model that integrates environmental rehabilitation with market liberalization. Key mechanisms such as the "triple integration" of credit, insurance, and proactive subsidies are proving essential for mitigating the high volatility of the sector and ensuring long-term food security. Furthermore, empirical evidence confirms that the introduction of innovative technologies—particularly digital monitoring and water-saving irrigation—is no longer optional but a fundamental prerequisite for the survival of Uzbek agricultural holdings in an increasingly arid climate.

Ultimately, the transformation of the agri-food sector requires a comprehensive policy package that links digital infrastructure development with robust green finance and transparent institutional frameworks. By completing the landmark land lease reforms by 2027 and continuing to leverage international cooperation for climate-resilient infrastructure, Uzbekistan is positioning its agricultural sector to become a model of sustainable development for emerging economies globally.

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