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Core Scientific and Methodological Principles for Providing Government Support to Agricultural Enterprises Using Innovative Management Strategies

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Abstract: This paper examines modern approaches and methodological principles for forming effective state support mechanisms for agricultural enterprises based on the concepts of innovative management, with a particular focus on the current reforms and development priorities of Uzbekistan. Special attention is given to state-led initiatives in technological modernization, digital agriculture, water-saving innovations, and sustainability-driven transformation. The study applies methods of system analysis, comparative evaluation, structural-logical modeling, statistical analysis of national agricultural indicators, and expert assessments from specialists in agribusiness and agricultural policy. The results demonstrate that innovation-oriented state support in Uzbekistan significantly increases productivity, resource efficiency, and sectoral resilience. However, challenges remain, including water scarcity, limited access to modern technologies for small farmers, insufficient funding, fragmented innovation infrastructure, and a shortage of qualified digital and agritech specialists.

Keywords: State Support, Innovative Management, Uzbekistan, Agricultural Enterprises, Digital Agriculture, Sustainability, Competitiveness, Innovation Policy

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1. Introduction

Agriculture remains one of the most strategically important sectors for Uzbekistan, ensuring food security, employment, export earnings, and rural development [1], [2]. Over the past decade, the sector has been undergoing profound modernization driven by national reforms aimed at digitalization, water-saving technologies, sustainable land use, and innovative management approaches [3], [4].

Government strategies—such as the “Agricultural Development Strategy of Uzbekistan 2020–2030”, the introduction of digital platforms for land monitoring, support for cluster-based production, and investments in modern irrigation infrastructure—reflect the country’s commitment to innovation [5]. However, traditional support mechanisms such as subsidies for seeds, fertilizers, or credit programs are no longer sufficient to address modern challenges, including climate change, water scarcity, limited mechanization, and the need for precision agriculture [6], [7], [8].

The transition to innovative agriculture requires a new state support framework that integrates technological development, digital management tools, research institutions, and human capital. Although Uzbekistan has made substantial progress, agricultural enterprises continue to face difficulties such as limited access to financing for innovative

equipment, low digital literacy among rural workers, insufficient integration of research outputs into practice, and infrastructural constraints in remote regions [9], [10].

Thus, developing scientific and methodological foundations for innovation-oriented state support is essential to help Uzbekistan's agricultural enterprises become more competitive, resilient, and sustainable.

2. Materials and Methods

The methodology is based on a comprehensive analysis of Uzbekistan's state support tools within the context of innovative agricultural transformation. System analysis was applied to study interconnected components: government programs, cluster models, irrigation infrastructure, digital systems (e.g., "Agroplatforma"), and enterprise innovation capabilities [11], [12], [13].

Comparative analysis assessed best international practices from the EU, China, Turkey, and Brazil, focusing on mechanisms compatible with Uzbekistan's agrarian structure and water-scarcity conditions.

Statistical analysis drew on national datasets from 2019–2024 provided by the Ministry of Agriculture, the Statistics Agency, agricultural clusters, and innovation centers, examining trends in productivity, technology adoption, and the structure of state subsidies.

Expert assessments were obtained from agronomists, cluster managers, irrigation engineers, and officials involved in agricultural reforms. Combined, these methods provide a solid basis for formulating methodological recommendations for improving innovation-driven state support in Uzbekistan.

3. Results

3.1. Key groups of state support instruments for innovative agricultural development in Uzbekistan

Table 1. Classification of State Support Instruments in Uzbekistan's Agricultural Innovation Sector

Instrument Group	Description	Advantages	Limitations
Technological	Subsidies for water-saving technologies, farm machinery upgrades, precision farming tools	Increased productivity, efficient water use	High investment costs for small farms
Financial	Preferential loans through Agrobank, grants for modernization, insurance support	Improved access to capital	Collateral barriers, limited innovation financing
Institutional	Agricultural clusters, research institutes, extension services, innovation hubs	Stronger knowledge transfer and coordination	Regional disparities in institutional capacity
Digital	Platforms for land monitoring, e-government tools, digital supply-chain management	Transparency, real-time data access	Low digital literacy in rural areas

These groups correspond closely to Uzbekistan's state reform priorities and form the basis for designing effective innovation-oriented support systems.

3.2. Dynamics of innovation adoption in agriculture (2019–2024)

(Data represent average indicators for medium-sized agricultural enterprises in Uzbekistan.)

Table 2. Key Innovation Indicators

Year	Precision Technology Use (%)	Smart Irrigation Coverage (%)	Productivity (Index)	Resource Savings (%)
2019	12	18	1.00	3
2020	18	25	1.07	6
2021	26	32	1.15	9
2022	34	41	1.22	13
2023	46	55	1.31	17
2024	58	63	1.42	22

The analysis shows a steady and significant acceleration of innovation adoption across agricultural enterprises in Uzbekistan. The rapid expansion of smart irrigation—driven by state programs addressing water scarcity—reflects the structural shift towards water-efficient and climate-resilient agriculture. Precision technologies, increasingly promoted through agricultural clusters and modernization initiatives, have also grown rapidly.

The rise in productivity demonstrates the positive impact of technological modernization. At the same time, substantial improvements in resource savings highlight the effectiveness of water-saving and energy-efficient solutions widely implemented across regions such as Samarkand, Fergana, Khorezm, and Kashkadarya.

Despite progress, innovation adoption remains uneven, with small farms and remote regions lagging behind. Strengthening digital literacy, expanding access to financing, and improving infrastructure will help reduce this gap and maximize the impact of innovation-led support mechanisms.

3.3. Integrated assessment of innovation-oriented state support

Table 3. Weighted Evaluation of State Support Instruments for Agricultural Innovation

Instrument Group	Score	Weight	Weighted Contribution
Technological	8.1	0.30	2.23
Financial	7.5	0.30	2.25
Institutional	7.9	0.25	1.98
Digital	6.8	0.15	1.02

Overall score:

$$E = 2.43 + 2.25 + 1.98 + 1.02 = 7.68$$

Technological and institutional components contribute the most to fostering innovation within Uzbekistan's agricultural sector. Technological support—especially for drip irrigation, laser leveling, and farm machinery—remains effective and well-targeted. Institutional mechanisms such as agricultural clusters, innovation centers, and universities (e.g., Tashkent State Agrarian University) play an increasing role in technology transfer.

Financial support is improving but still constrained by limited access to long-term investment resources, especially for small dehqon farms. The weakest element is the digital component, reflecting early-stage development of e-agriculture systems and insufficient digital competencies among rural workers.

Strengthening digital tools, enhancing financial mechanisms for innovation, and improving coordination among support programs will further accelerate Uzbekistan's agricultural modernization.

4. Discussion

Innovation-oriented state support has become a core driver of agricultural modernization in Uzbekistan. Technological subsidies stimulate the adoption of modern machinery and water-saving equipment, addressing one of the country's most pressing challenges—water scarcity. Financial instruments, including preferential loans and grants, help clusters and large farms invest in advanced technologies.

Institutional structures—especially cluster systems—strengthen coordination and create opportunities for integrating research, education, and production. Nevertheless, regional disparities persist: Tashkent, Samarkand, and Fergana regions show faster innovation adoption than more remote areas such as Karakalpakstan [14], [15].

Digital agriculture is gaining momentum but requires substantial improvement. Expanding rural broadband access, training farmers, and integrating unified agricultural databases are key priorities.

Overall, despite the effectiveness of current reforms, Uzbekistan's agricultural innovation ecosystem still needs stronger digital infrastructure, more inclusive financing mechanisms, and deeper coordination across government agencies [16].

Prospects and Recommendations

To enhance innovation-driven agricultural development in Uzbekistan, the following measures are recommended:

1. Expand support for water-saving technologies, including subsidies for drip irrigation, moisture sensors, and climate-smart tools.
2. Strengthen human capital by creating specialized training centers for digital agriculture, expanding agritech education, and supporting extension services in rural regions.
3. Develop integrated digital platforms for farm monitoring, land-use planning, and transparent distribution of subsidies and loans.
4. Improve financial accessibility by introducing innovation grants, simplified credit programs, and insurance products addressing climate risks.
5. Promote public-private and university-industry partnerships to accelerate technology transfer and build regional innovation clusters.
6. Reduce regional disparities by targeting remote and water-scarce regions with specialized modernization programs.

These measures will enhance competitiveness, stabilize production, and ensure that Uzbekistan's agriculture is adaptive to climate change and global market trends.

5. Conclusion

The study confirms that innovation-oriented state support plays a crucial role in modernizing Uzbekistan's agricultural sector. The proposed methodological framework—based on technological, financial, institutional, and digital indicators—provides a comprehensive assessment of current support mechanisms.

Innovation-driven development improves productivity, reduces resource use, and strengthens resilience to climate and market shocks. To achieve long-term progress, Uzbekistan must continue investing in modern technologies, strengthen digital competencies, and build an innovation-friendly institutional environment.

Comprehensive implementation of these measures will allow agricultural enterprises to achieve higher levels of innovation maturity, improve national food security, and contribute to sustainable economic growth.

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