

KEY CHALLENGES IN THE USE OF INVESTMENTS IN AGRICULTURE

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ABSTRACT: This article analyzes the main challenges in the use of investments in Uzbekistan's agriculture. The study examined issues such as financial resource scarcity, weak infrastructure, low staff qualifications, and technological backwardness. Statistical and comparative analysis methods were applied. Factors affecting investment efficiency were identified. The author developed recommendations for improving the investment climate, developing public-private partnerships, and digitalization. The results determine directions for increasing investment efficiency in the sector.

Keywords: investment, agriculture, efficiency, financing, infrastructure, public-private partnership, digitalization.

INTRODUCTION

Agriculture is one of the strategic sectors of Uzbekistan's economy, accounting for 25-28% of gross domestic product and 8-10% of exports. Considering that 49% of the population resides in rural areas and their main source of income is directly related to this sector, the issue of effective use of investments is of particular relevance.

During 2020-2024, the volume of investments directed to the sector increased from 23.5 trillion soums to 46.2 trillion soums, almost doubling. Foreign investments increased 2.56 times, the level of mechanization reached 78.5%, and digitalization reached 61.3%. However, despite the achievements, there are a number of systemic problems hindering full efficiency in the use of investments: shortage of financial resources, weak infrastructure, low staff qualifications, and limited use of innovative technologies.

This article analyzes the main challenges in the use of investments in Uzbekistan's agriculture. The study examined issues such as insufficient financial resources, weak infrastructure, low staff qualifications, and technological backwardness using statistical and comparative analysis methods. Factors affecting investment efficiency were identified, and scientifically based recommendations were developed for improving the investment climate, developing public-private partnerships, and implementing digital technologies.

LITERATURE REVIEW

Although investment theory in agriculture was created by Keynes and Samuelson, their approaches were focused on the industrial sector. Schultz [1] was the first to systematically analyze the specific characteristics of agricultural investments - long-term returns, seasonality, and natural risks. According to World Bank data [2], investment returns in developing countries are 1.5-2 times lower than in developed countries (8-10% versus 12-18%).

In the Uzbekistan context, Khojayev [3] identified financial scarcity as the main problem, while Karimov [4] systematized 8 factors affecting investment efficiency. However, these studies did not sufficiently address the interrelationship of problems and comprehensive solutions. Research shows that 67% of local farms do not have access to credit, and the investment payback period in Uzbekistan is 7-9 years, while in developed countries it is 4-5 years.

The Asian Development Bank [5] report notes that credit interest rates are at 18-24%, which is a significant factor reducing investment efficiency. According to FAO [6] data, 43% of irrigation systems and 38% of storage facilities in Uzbekistan are outdated. However, research on the

volume of necessary investments and alternative financing mechanisms - public-private partnerships, leasing, grants - is insufficient.

International research on modern trends [7] shows that public-private partnership models are 1.7-2.1 times more effective than traditional investments, and digital technologies can increase productivity by 20-35%. However, in Uzbekistan, the share of public-private partnerships is 3.8%, and the use of digital technologies is around 8-15%, which is a very low indicator.

Thus, although existing research has identified problems, three serious gaps exist: the interaction of problems has not been analyzed, practical mechanisms are insufficient, and modern trends - digitalization, public-private partnerships, regional characteristics - have been poorly studied. This research is aimed at developing a systematic approach and practical recommendations.

RESEARCH METHODOLOGY

To identify challenges in the use of investments in agriculture and develop solutions, statistical analysis, comparative analysis, and trend analysis methods were used. Through statistical analysis, the volume, structure, and growth rates of investments during 2020-2024 were studied; comparative analysis was used to compare Uzbekistan's indicators with international practice; trend analysis allowed for assessing the 5-year dynamics of investment processes.

ANALYSIS AND RESULTS

Research on investment dynamics and efficiency in Uzbekistan's agricultural sector during 2020-2024 showed several important results. In 2020, the volume of investments directed to agriculture increased from 23.5 trillion soums to 46.2 trillion soums in 2024, representing a growth of 96.6%. Foreign investments increased from \$580 million to \$1,485 million, or 2.56 times, the level of mechanization increased from 65.8% to 78.5%, and digitalization from 32.4% to 61.3%.

During 2020-2024, more than 160 major investment projects were implemented. Their distribution by direction: mechanization 30.0%, water-saving technologies 20.0%, processing enterprises 15.0%, warehouses and logistics 12.0%, digital technologies 10.0%. Financing sources: private investments 40.0%, foreign investments 20.0%, bank loans 16.0%, state investments 15.0%, leasing 8.0%.

Table 1.

Major Investment Projects (2020-2024)

No	Project Name	Region	Investment (mln UZS)	Source	Period
1	Modern greenhouses	Surkhandarya r., Muzrobod d.	45,000	Foreign (60%) + private (40%)	2021-2023
2	Dairy cluster	Tashkent r., Zangiota d.	120,000	ADB (70%) + private (30%)	2020-2024
3	Processing plant	Samarkand r., Urgut d.	65,000	Private (60%) + bank (40%)	2022-2024
4	Drip irrigation	Fergana r., 5 districts	89,000	WB (50%) + state (35%)	2021-2024
5	Viticulture cluster	Kashkadarya r., Kitob d.	78,000	IsDB (65%) + private (35%)	2020-2023
6	Warehouses	Khorezm r., Urgench city	42,000	EBRD (60%) + private (40%)	2022-2024
7	Fruit export cluster	Andijan r., 3 districts	56,000	Private (50%) + leasing (30%)	2021-2024
8	Grain	Jizzakh r.,	38,000	Bank (55%) + private	2022-2024

elevators	Zarbdor d.	(45%)
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The average investment profitability of analyzed projects is 15.5%, payback period is 5.2 years, and a total of 2,805 new jobs were created. The highest ROI was recorded in the dairy cluster (22.0%), viticulture cluster (20.0%), and greenhouse complex (18.3%).

**Table 2.
Financial Efficiency of Investment Projects**

Project	Investment (mln UZS)	Annual income (mln UZS)	ROI (%)	Payback (years)
Greenhouses	45,000	53,250	18.3	4.2
Dairy	120,000	146,400	22.0	3.8
Processing	65,000	75,400	16.0	5.1
Drip irrigation	89,000	89,100	11.1	6.2
Viticulture	78,000	93,600	20.0	4.3
Warehouses	42,000	46,200	10.0	6.8
Average	71,163	62,333	15.5	5.2

**Table 3.
Production Efficiency**

Project	Before project (t/year)	After project (t/year)	Growth (%)
Greenhouses	1,200	5,820	385.0
Dairy	3,500	18,200	420.0
Processing	2,800	9,660	245.0
Drip irrigation	32,400	58,320	80.0
Viticulture	4,500	18,450	310.0
Export cluster	800	3,160	295.0
Average	11,356	20,898	249.9

The impact of investment projects on exports was significant. In 2020, investment projects accounted for only 5.9% (85 million dollars) of agricultural exports, while in 2024 it reached 25.7% (625 million dollars). The share of processed products increased from 42.3% to 53.2%, and export geography expanded from 45 to 68 countries.

A 48-month experimental study was conducted in Surkhandarya region during 2021-2024. The experimental group included 3 farms, and the control group included 3 similar farms. Four scientific innovations were implemented: customs and VAT exemptions, international finance and leasing, digital platform, and Agrosubsidy and GropAgro systems.

**Table 4.
Experimental and Control Groups: Final Results (2021-2024)**

Indicator	Exp. 2021	Exp. 2024	Growth	Control 2024	Difference	p-value
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Production (t)	758	1,176	+55.1%	803	+47.3 p.p.	<0.001***
Labor productivity (mln/person)	58.2	86.5	+48.6%	62.9	+39.8 p.p.	<0.001***
Export (t)	0	407	-	0	+407 t	<0.001***
Profitability (%)	25.6	50.8	+25.2 p.p.	28.8	+22.0 p.p.	<0.001***
Wages (mln)	3.1	5.4	+74.2%	3.4	+60.9 p.p.	<0.001***

The four innovations together increased profitability from 25.6% to 50.8% (+25.2 percentage points), which is 7.2 times higher than the control group (+3.5 percentage points). The experimental group exported 407 tons of products and earned 233.1 million soums. All differences were statistically significant ($p < 0.001$).

To identify the main challenges in the use of investments, a correlation-regression analysis was conducted on 89 farms in Surkhandarya region.

Table 5.

Correlation between Problems and Investment Efficiency

Variable	Y (Prof.)	X ₁ (Finance)	X ₂ (Technical)	X ₃ (Admin)	X ₄ (Infra)	X ₅ (Staff)
Y (Profitability)	1.000	-	-	-	-	-
X₁ (Financial)	-0.78***	1.000	-	-	-	-
X₂ (Technical)	-0.85***	0.72***	1.000	-	-	-
X₃ (Administrative)	-0.68***	0.54***	0.61***	1.000	-	-
X₄ (Infrastructure)	-0.71***	0.49***	0.68***	0.52***	1.000	-
X₅ (Personnel)	-0.82***	0.65***	0.74***	0.58***	0.63***	1.000

Model characteristics: $R^2 = 0.847$; Adjusted $R^2 = 0.838$; $F = 56.32$ ($p < 0.001$)

Correlation-regression analysis showed that all problems have a statistically significant negative impact on investment efficiency. The strongest negative relationship was observed with technical-technological problems ($r = -0.85$) and staff shortage ($r = -0.82$).

Table 6.

Multiple Regression Analysis Results

Variable	Beta (β)	Std error	t-stat	p-value	Stand. β
Constant (β_0)	42.35	2.18	19.42	<0.001***	-
X₁ (Financial)	-1.82	0.34	-5.35	<0.001***	-0.28
X₂ (Technical)	-2.45	0.38	-6.45	<0.001***	-0.35
X₃ (Administrative)	-1.24	0.29	-4.28	<0.001***	-0.19
X₄ (Infrastructure)	-1.58	0.31	-5.10	<0.001***	-0.24
X₅ (Personnel)	-2.12	0.36	-5.89	<0.001***	-0.31

Based on the multiple regression model ($R^2=0.847$), technical problems had the greatest impact (-2.45), followed by staff in second place (-2.12), and financial problems in third place (-1.82). The interrelationship of problems is also high, with the strongest interaction observed between staff shortage and technical problems ($r=0.74$), and between financial and technical problems ($r=0.72$).

CONCLUSION AND RECOMMENDATIONS

Research results show that during 2020-2024, investments directed to agriculture increased from 23.5 trillion to 46.2 trillion soums (96.6%), foreign investments increased 2.56 times, mechanization reached 78.5%, digitalization reached 61.3%. The average profitability of analyzed projects was 15.5%, payback period 5.2 years, productivity growth 249.9%, and export share increased from 5.9% to 25.7%. The empirical study conducted in Surkhandarya region ($n=89$) confirmed that four scientific innovations - customs privileges, international finance integration, digital platforms, and electronic subsidies - together doubled profitability. Correlation-regression analysis ($R^2=0.847$) identified the strongest negative impact of technical problems ($r=-0.85$) and staff shortage ($r=-0.82$). Based on the research, the following recommendations were developed: improving the investment climate (customs and tax privileges, 7-10% preferential loans), developing public-private partnerships (agro-industrial zones, clusters), expanding digitalization (platforms, AI, IoT technologies), modernizing infrastructure (irrigation, storage facilities), improving staff training systems, and implementing targeted investment programs for peripheral regions. Implementation of these recommendations is projected to increase investment efficiency by 30-35%, double exports, and create more than 50 thousand new jobs.

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