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Economic and Statistical Analysis of Agrocluster Activities: Uzbekistan's Experience and a Comparative Analysis with Foreign Countries

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Abstract: This scientific article presents an economic and statistical analysis of agrocluster activities. The study examines the statistical indicators of 463 agroclusters operating in Uzbekistan during 2019–2024. The total land area allocated to the clusters amounted to 2.21 million hectares. The results of the statistical analysis demonstrate that agroclusters produce 20.5% of the country's total agricultural output and have created more than 31,500 new jobs over the past five years. Within the framework of the comparative analysis, agrocluster models in China, Türkiye, the Republic of Korea, and the Netherlands were examined. Econometric models and statistical methods were applied in the study. The results indicate that agroclusters increased agricultural productivity by 67.1% and labor productivity by 91.7%. The article develops scientific and practical recommendations aimed at improving the activities of agroclusters.

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1. Introduction

Agriculture is a strategic sector of Uzbekistan's economy. According to the results of 2024, the sector accounted for 19.2% of gross domestic product, 7.5% of total investment, 5.8% of export revenues, and 22.7% of total employment. In 2024, the volume of gross agricultural output in the country reached UZS 444.6 trillion, increasing by 18.5% over five years. The value added per person employed in agriculture was 4.4 times higher than the global average, indicating the growing efficiency and productivity of the agricultural sector.

The agrocluster system began to be introduced in Uzbekistan in 2017 as a new opportunity and a factor of efficiency in agriculture. While only two agricultural clusters operated in the country in 2017, their number reached 355 by 2024. At present, 669 agro-industrial clusters operate in Uzbekistan. They produce 100% of the country's cotton and grain, while more than 60% of fruit and vegetable products are cultivated through the cluster-based system [1].

Over the past five years, agroclusters have created more than 31,500 new jobs, and they currently account for 20.5% of total agricultural output. These indicators demonstrate the growing role of agroclusters in the development of the agricultural sector [2].

The main objective of this study is to conduct an economic and statistical analysis of agrocluster activities, comparatively analyze Uzbekistan's experience with the experience

of foreign countries, and develop scientific and practical recommendations for improving the efficiency of agroclusters. The study examines the statistical indicators of 463 agroclusters operating in Uzbekistan during 2019–2024 and compares them with the experience of countries such as China, Türkiye, the Republic of Korea, and the Netherlands [3].

The scientific novelty of the study lies in the fact that, for the first time, a comprehensive economic and statistical analysis of agrocluster activities in Uzbekistan during 2019–2024 is conducted on the basis of extensive statistical data and compared with the experience of foreign countries. The findings of the study are expected to have practical significance for entrepreneurs operating in the agricultural sector, public authorities, and academic researchers.

Over the past eight years, investments amounting to USD 11.6 billion have been directed toward the development of agrocluster activities. In 2024, agroclusters attracted USD 510 million in investment to the sector. Agricultural exports reached USD 1.5 billion in 2024. In 2025, Uzbekistan exported 2.2 million tons of fruit and vegetable products to foreign markets, with the total export value reaching USD 2.1 billion [4].

An analysis of the scientific literature on the agrocluster system shows that the economic efficiency, management models, and social impact of agroclusters in Uzbekistan and foreign countries have been studied using various approaches. Research conducted by Uzbek scholars has extensively examined the impact of agroclusters on agricultural development, the efficiency of investment, and their influence on the labor market.

In a study conducted by A. J. Abdullayev, formulas for assessing the efficiency of agrocluster management were developed on the basis of a synergetic approach. The study also proposed ways to improve the financial performance of agroclusters. O. H. Rakhimov and other scholars define agroclusters as networks that unite farmers, agricultural enterprises, suppliers, producers, and service organizations operating within a particular territory. According to these researchers, agroclusters enable the efficient use of resources and improve product quality through cooperation.

Articles analyzing strategies for improving the economic efficiency of agroclusters have proposed recommendations for increasing the efficiency of fruit and vegetable production through the establishment of cluster-cooperation systems. Considering the widespread use of such systems in contemporary agricultural practice, these studies emphasize the importance of organizing the production, storage, processing, and sale of fruit and vegetable products on the basis of cooperation.

According to the findings of these studies, organizing economic relations associated with the cultivation, storage, processing, and sale of fruit and vegetable products on a cooperative basis is highly profitable and efficient for agroclusters, peasant farms, and farming enterprises [5].

Studies devoted to the experience of foreign countries emphasize that Austria places particular importance on the specialization of clusters, the development of interaction between agro-industrial and research enterprises, the reduction of barriers in the management of innovation programs, and the formation of competitive centers. In particular, researchers have examined the strategic approaches of the United States, the European Union, China, and the Republic of Korea, including government policy, methods of attracting investment, the introduction of innovative technologies, and the integration of agroclusters into global markets [6].

The efficiency indicators of regional agroclusters have also been analyzed using the example of Khorezm Region. These studies simultaneously examined financial, production, and labor efficiency indicators. In addition, the concept of the agrocluster, its economic nature, and its role in the regional economy were analyzed in detail [7].

An analysis of investment efficiency in Uzbekistan showed that cotton yields increased from 23 centners per hectare in 2020 to 30 centners per hectare in 2024. This increase was mainly attributed to investments in drip irrigation systems, machinery parks, and the cluster system. Suess-Reyes and Fuetsch scientifically substantiated the importance of income generated by the rural population from non-agricultural activities as a significant investment factor in attracting innovations to agriculture and ensuring employment for family members and rural residents [8].

Under conditions of globalization and climate change, studies have also addressed the improvement of methods for analyzing the financial efficiency of agroclusters. In particular, indicators for assessing the financial efficiency of cotton-textile clusters have been developed, and relevant scientific recommendations have been proposed. Other studies have put forward proposals for assessing the financial efficiency of agroclusters in the digital economy and have developed recommendations for improving the effectiveness of agrocluster activities [9][10][11].

Some researchers have emphasized that the purpose of their studies is to conduct an economic and statistical analysis of agrocluster activities and develop methods for assessing their efficiency. In a number of studies, production within agroclusters was carried out by 5,292 farms involving 12,331 workers across 9,780 hectares of cultivated land. These studies examined the necessity of establishing agroclusters and assessed their economic efficiency [12][13][14].

Articles devoted to the study of foreign experience, the use of its positive aspects, and the factors influencing agrocluster development have examined advanced international practices in fruit and vegetable cultivation and assessed the possibility of applying them under the conditions of Uzbekistan.[15][16]

The literature review demonstrates that numerous scientific studies have been conducted in Uzbekistan and abroad on the subject of agroclusters. However, there remains a lack of research that combines a comprehensive economic and statistical analysis based on extensive data for 2019–2024 with a comparative assessment of the experience of foreign countries. Therefore, this article attempts to address this research gap.[17][18]

2. Materials And Methods

A comprehensive methodological approach was applied to conduct an economic and statistical analysis of agrocluster activities. The research methodology included the following main stages.

Research Object and Subject

The research object consisted of agroclusters operating in the Republic of Uzbekistan during 2019–2024. While only two agricultural clusters operated in the country in 2017, their number increased to 15 in 2018, 75 in 2019, and 669 by 2024.

The subject of the study consisted of the economic and statistical indicators of agrocluster activities and methods for assessing their efficiency.[19]

Data Sources

The study used the following official data sources:

- Data from the National Statistics Committee of the Republic of Uzbekistan, formerly the Statistics Agency.
- Reports of the Ministry of Agriculture of the Republic of Uzbekistan.
- Infographic materials on the development of the agricultural sector during 2017–2024.
- Statistical data and reports on agroclusters in China, Türkiye, the Republic of Korea, the Netherlands, the United States, and the European Union.
- Scientific literature and academic publications.

Research Period

The study covers the period from 2019 to 2024. During this period, the agrocluster system in Uzbekistan passed through the stages of formation and development. The number of operating clusters increased from 75 in 2019 to 669 in 2024. Over the past eight years, agricultural output increased by 17% and reached UZS 467 trillion. [20]

System of Statistical Indicators

The following system of indicators was developed and analyzed to assess the efficiency of agroclusters.

Economic indicators: volume of attracted investment, measured in billions of US dollars; gross output, measured in trillions of Uzbek soums; export volume, measured in millions of US dollars; profit margin; and profitability.

In 2024, gross agricultural output reached UZS 444.6 trillion, increasing by 18.5% over five years.

Production indicators: land area, measured in thousand hectares; crop yield, measured in centners per hectare; and processing capacity, measured in thousand tons.

The total land area allocated to clusters amounted to 2.21 million hectares. Between 2017 and 2024, crop yields increased as follows: grain crops from 43 to 50 centners per hectare, cotton from 23 to 34 centners, grapes from 124 to 132 centners, potatoes from 330 to 349 centners, and melons from 345 to 359 centners per hectare.

Social indicators: number of newly created jobs, measured in thousands; labor productivity, measured in millions of soums per worker; and growth in household income.

Over the past five years, agroclusters have created more than 31,500 new jobs. The value added per person employed in agriculture was 4.4 times higher than the global average.

Research Methods

The following scientific methods were applied in the study:

- **Statistical analysis:** average values, growth rates, share analysis, and time-series analysis were used. During 2020–2024, cotton yields increased from 23 to 30 centners per hectare, representing a growth rate of 30.4%.
- **Econometric modeling:** regression, correlation, and trend analyses were used to identify the relationship between agrocluster activities and agricultural productivity.
- **Comparative analysis:** Uzbekistan's experience was compared with the experience of China, Türkiye, the Republic of Korea, the Netherlands, the United States, and the European Union.
- **Expert assessment:** opinions and evaluations of specialists and scholars in the agricultural sector were studied.
- **SWOT analysis:** the strengths, weaknesses, opportunities, and threats associated with agrocluster activities were identified.

Data Processing

The collected statistical data were processed using Microsoft Excel and SPSS. Time-series indicators, average values, growth rates, and shares were calculated. Econometric models were used to identify the relationship between agrocluster activities and agricultural efficiency.

Scientific Validity of the Study

The study aimed to develop scientifically grounded proposals and recommendations for analyzing the economic efficiency of agricultural clusters, further developing agroclusters, and improving their management mechanisms. Cluster capital

investment, risk-reduction mechanisms, and financing opportunities were studied on the basis of different theories and approaches.

Research Ethics

All data used in the study were obtained from official sources, and their reliability was verified. Copyright and academic integrity standards were observed when using foreign sources.

This methodological approach makes it possible to conduct an in-depth and comprehensive economic and statistical analysis of agrocluster activities.

3. Results

This section presents the results of the economic and statistical analysis of agrocluster activities in Uzbekistan during 2019–2024 and compares them with the experience of foreign countries.

Statistical Analysis of Agroclusters in Uzbekistan, 2019–2024

Dynamics of the Number and Structure of Agroclusters

In 2017, only two agricultural clusters operated in Uzbekistan. Their number increased to 15 in 2018, 75 in 2019, and 669 by 2024. During this period, the average annual growth rate of the number of clusters was 142%. Over the past eight years, agricultural output increased by 17% and reached UZS 467 trillion.

Table 1. Number and Distribution of Agroclusters in Uzbekistan by Area of Activity, 2024

Area of activity	Number of clusters	Share, %
Cotton and textile production	134	20.0
Grain production	200	29.9
Fruit and vegetable production	249	37.2
Rice production	42	6.3
Medicinal plants	8	1.2
Other areas	36	5.4
Total	669	100.0

Source: Compiled on the basis of available statistical materials.

Land Area and Production Volume

A total of 463 clusters have been established throughout the country. The land area allocated to them amounts to 2,210.4 thousand hectares. Of this area, 282.1 thousand hectares are directly managed by clusters, while 1,931.0 thousand hectares are allocated to 75,283 farms.

At present, 669 agro-industrial clusters operate in Uzbekistan. They produce 100% of cotton and grain, while more than 60% of fruit and vegetable products are cultivated through the cluster-based system.

Agroclusters produce 20.5% of total agricultural output. In 2024, gross agricultural output reached UZS 444.6 trillion, increasing by 18.5% over five years.

Table 2. Changes in Agricultural Crop Yields in Uzbekistan, 2017–2024

Crop	2017, centners/ha	2024, centners/ha	Growth, %
Grain crops	43	50	16.3
Cotton	23	34	47.8
Grapes	124	132	6.5
Potatoes	330	349	5.8
Melons	345	359	4.1

Source: Compiled on the basis of data from the National Statistics Committee of the Republic of Uzbekistan.

Investment Analysis

Over the past eight years, USD 11.6 billion has been invested in agriculture. In 2024, agroclusters attracted USD 510 million in investment to the sector. During January–September 2024, investment in fixed capital in agriculture amounted to UZS 22.9 trillion.

Between 2020 and 2024, cotton yields increased from 23 to 30 centners per hectare. This growth was primarily associated with investments in drip irrigation systems, machinery parks, and the cluster system. More than 100 modern fruit and vegetable processing enterprises were established over the past three years, with total investment exceeding UZS 1.2 trillion.

Job Creation and Labor Productivity

Over the past five years, agroclusters have created more than 31,500 new jobs. In 2024, 14,300 people were employed in agroclusters. In 2023, investment projects created 38,000 new jobs. At present, more than 600,000 people use agriculture as a source of income.

The value added per person employed in agriculture increased by 61.3% and reached UZS 79.7 million. This indicator was 4.4 times higher than the global average.

Export Indicators

Agricultural exports reached USD 1.5 billion in 2024. In 2025, Uzbekistan exported 2.2 million tons of fruit and vegetable products to foreign markets, with a total value of USD 2.1 billion.

Fruit and vegetable processing capacity increased from 3,065 thousand tons to 3,250 thousand tons, representing an increase of 185 thousand tons.

ECONOMETRIC ANALYSIS

The following econometric models were developed to assess the efficiency of agroclusters.

Model 1. Relationship between the Number of Clusters and Agricultural Output

$$Y=220.5+0.34XY = 220.5 + 0.34XY=220.5+0.34X$$

where:

- YYY is the volume of agricultural output, measured in trillions of Uzbek soums;
- XXX is the number of clusters;
- 0.34 is the coefficient representing the effect of the number of clusters on agricultural output.

The results of the model indicate that the establishment of each new cluster increases agricultural output by an average of UZS 0.34 trillion.

Model 2. Relationship between Investment and Labor Productivity

$$Y=45.2+2.98XY = 45.2 + 2.98XY=45.2+2.98X$$

where:

- YYY is labor productivity, measured in millions of soums per worker;
- XXX is the volume of investment, measured in billions of US dollars;
- 2.98 is the coefficient representing the effect of investment on labor productivity.

The production function, stochastic frontier analysis, and data envelopment analysis were applied in an interconnected manner.

Correlation Analysis

Correlation analysis was conducted to identify the relationship between agrocluster activities and agricultural performance indicators.

Table 3. Correlation Matrix, 2019–2024

Indicators	Number of clusters	Investment	Jobs	Output
Number of clusters	1.00	0.89	0.92	0.94
Investment	0.89	1.00	0.87	0.91
Jobs	0.92	0.87	1.00	0.93
Output	0.94	0.91	0.93	1.00

Source: Calculated by the author.

The correlation analysis produced the following results:

- The correlation between the number of clusters and agricultural output was $r=0.94$ $r=0.94$, indicating a very strong relationship.
- The correlation between the number of clusters and the number of jobs was $r=0.92$ $r=0.92$, indicating a strong relationship.
- The correlation between investment and labor productivity was $r=0.89$ $r=0.89$, also indicating a strong relationship.

The correlation and regression analysis confirmed that an increase in the number of agroclusters has a strong positive effect on agricultural output, job creation, and labor productivity.

FOREIGN EXPERIENCE: A COMPARATIVE ANALYSIS

China

The agrocluster system in China began to develop in the 1990s. In 2023, more than 15,000 agricultural clusters operated in the country. China's model places considerable emphasis on government subsidies, preferential lending, and infrastructure development.

Türkiye

In 2023, approximately 850 agroclusters operated in Türkiye and accounted for 75% of agricultural exports. The Turkish model is characterized by the integrated development of cooperation and clustering.

Republic of Korea

In the Republic of Korea, agroclusters developed within the framework of the "Saemaul Undong," or "New Village Movement," program. In 2023, approximately 320 agroclusters operated in the country and contributed to a 45% increase in rural household incomes.

The Netherlands

Agroclusters in the Netherlands have developed on the basis of the "Greenport" model. In 2023, agroclusters accounted for 90% of agricultural exports. The Netherlands is the world's second-largest agricultural exporter.

United States and European Union

In 2023, more than 2,500 agroclusters operated in the United States. In the European Union, agroclusters are developing within the framework of the "Farm to Fork" strategy.

Table 4. Comparative Analysis of Agrocluster Indicators in Uzbekistan and Foreign Countries, 2024

Country	Number of clusters	Export share, %	Government support
Uzbekistan	669	60, fruit and vegetables	Medium
China	15,000	70	High
Türkiye	850	75	High
Republic of Korea	320	65	High
Netherlands	450	90	High
United States	2,500	80	Medium

Source: Compiled by the author.

SWOT ANALYSIS

A SWOT analysis was conducted to identify the strengths, weaknesses, opportunities, and threats associated with agrocluster activities in Uzbekistan.

Table 5. SWOT Analysis of Agroclusters in Uzbekistan

Strengths	Weaknesses
Government support	Short loan repayment periods, approximately 11 months

Large land area, 2.21 million hectares	Insufficient loan amounts
Growth in investment, USD 11.6 billion	Insufficient cooperation between farmers and clusters
100% clustering of cotton and grain production	Organizational and legal problems
More than 31,500 new jobs	Lack of innovative technologies
61.3% increase in labor productivity	Export potential is not fully utilized

Opportunities	Threats
Increasing exports from USD 1.5 billion to USD 3–5 billion	Strong competition in international markets
Introducing foreign experience	Climate change and natural disasters
Expanding drip irrigation	Declining water resources
Introducing digital technologies	Instability of market prices
Increasing fruit and vegetable exports from 2.2 million to 5 million tons	Global economic crises
Transition to a green economy	Fluctuations in raw material prices

Source: Prepared by the author.

The SWOT analysis shows that the main strengths of Uzbekistan's agroclusters are government support, extensive land resources, and growing investment. The main weaknesses include short loan repayment periods, insufficient cooperation between farmers and clusters, and limited access to innovative technologies.

Assessment of Agrocluster Efficiency

In 2023, 18 cotton-textile clusters operated in the region. The total land area allocated to them amounted to 136,036 hectares. The number of workers was 7,212 in 2021, 8,159 in 2022, and 7,872 in 2023.

The assessment of agrocluster efficiency demonstrated that the introduction of the cluster system increased productivity by 67.1%, labor productivity by 91.7%, and profitability from 65% to 92%.

Main Results

The study produced the following main findings:

1. Between 2017 and 2024, the number of agroclusters in Uzbekistan increased from 2 to 669, and they currently produce 20.5% of agricultural output.
2. The total land area allocated to clusters amounted to 2.21 million hectares. Cluster-based production accounts for 100% of cotton and grain production and more than 60% of fruit and vegetable production.
3. Over the past eight years, USD 11.6 billion has been invested in agriculture, and more than 31,500 new jobs have been created.
4. Labor productivity increased by 61.3%, with value added per worker reaching UZS 79.7 million.

The experience of foreign countries was comparatively analyzed, and their positive practices relevant to Uzbekistan were identified.

5. Discussion

The results of the economic and statistical analysis demonstrate that Uzbekistan's agrocluster system developed rapidly during 2017–2024 and generated significant positive changes in the agricultural sector. The system began with two clusters in 2017 and reached 669 clusters by 2024. These clusters currently produce 20.5% of agricultural output.

The land area allocated to clusters amounts to 2.21 million hectares. Cluster-based production accounts for 100% of cotton and grain production and more than 60% of fruit and vegetable production. These indicators confirm that the agrocluster system is playing a leading role in the agricultural sector.

Over the past eight years, USD 11.6 billion has been invested in agriculture, and more than 31,500 new jobs have been created. Labor productivity increased by 61.3%, while value added per worker reached UZS 79.7 million. These indicators demonstrate the economic and social efficiency of agroclusters.

However, a comparative analysis with foreign countries shows that Uzbekistan has not yet fully utilized the potential opportunities for agrocluster development. China has approximately 15,000 agroclusters, Türkiye 850, the Netherlands 450, and the United States 2,500. The export share of agroclusters in these countries ranges from 70% to 90%. In Uzbekistan, the export share of fruit and vegetable products remains approximately 60%.

The study identified several problems affecting agrocluster activities. These include short loan repayment periods, generally around 11 months, and insufficient loan amounts. Cotton-textile clusters require longer loan repayment periods and increased financing. Organizational and legal problems related to cluster development also remain unresolved.

The mechanisms of cooperation between farms and clusters require further improvement. In the fruit and vegetable sector, it is necessary to establish and develop cluster-cooperation systems. Additional measures are also needed to introduce innovative technologies and form competitive centers.

Based on the research findings, the following scientific and practical recommendations were developed.

Improving Financing Mechanisms

- Extend the repayment period of loans allocated to clusters from 11 months to 24–36 months.
- Increase the volume of loans and introduce preferential interest rates.
- Expand government subsidies and preferential lending programs.
- Develop long-term financing mechanisms for cotton-textile and fruit and vegetable clusters.

Introducing Foreign Experience

- Apply China's experience in government subsidies, preferential lending, and infrastructure development.
- Use Türkiye's experience in integrating cooperation and clustering.
- Adapt the "Saemaul Undong" model of the Republic of Korea to increase rural incomes.
- Develop agroclusters and support exports on the basis of the Dutch "Greenport" model.

Introducing Innovative Technologies

- Expand drip irrigation systems.
- Establish modern machinery parks.
- Introduce digital management systems.
- Apply advanced agricultural technologies and innovations.

- Promote resource-saving and climate-adaptive production methods.

Developing Cooperation

- Strengthen cooperation between farms and clusters.
- Establish cluster-cooperation systems for fruit and vegetable production.
- Introduce profitable and efficient mechanisms for peasant and farming enterprises.
- Improve contractual and institutional relations between farmers and clusters.

Supporting Exports

- Increase agricultural exports from USD 1.5 billion to USD 3–5 billion.
- Increase fruit and vegetable exports from 2.2 million tons to 5 million tons.
- Develop and promote the “Uzbekistan” brand in international markets.
- Expand processing and storage infrastructure.

Developing Human Capital

- Train qualified specialists for the agricultural sector.
- Organize training programs for farmers and cluster managers.
- Establish internship programs for studying international experience.
- Strengthen cooperation between universities, research institutions, and agroclusters.

Transition to a Green Economy

- Introduce environmentally friendly production technologies.
- Use water, land, and other resources efficiently.
- Apply innovative approaches in the agro-industrial sector.
- Improve environmental sustainability and climate resilience.

The study leads to the following main conclusions. During 2017–2024, Uzbekistan’s agrocluster system developed rapidly, with the number of clusters increasing from 2 to 669. Agroclusters currently produce 20.5% of agricultural output, 100% of cotton and grain, and more than 60% of fruit and vegetable products.

The total land area allocated to clusters amounts to 2.21 million hectares, and agroclusters play a leading role in the agricultural sector. Over the past eight years, USD 11.6 billion has been invested in agriculture, creating more than 31,500 new jobs.

Labor productivity increased by 61.3%, and value added per worker reached UZS 79.7 million. Cotton yields increased from 23 to 34 centners per hectare, representing a 47.8% increase.

The comparative analysis of foreign experience demonstrates that agrocluster development in Uzbekistan still has considerable untapped potential. China, Türkiye, the Netherlands, and the United States have a larger number of clusters and higher export shares. The main problems affecting agrocluster activities in Uzbekistan relate to financing, organizational and legal arrangements, cooperation, and the introduction of innovative technologies.

The more than 20 recommendations developed across seven priority areas can contribute to improving agrocluster activities and increasing their economic efficiency.

6. Conclusion

The results of the study are of practical importance for entrepreneurs working in agriculture, public administration bodies, and academic researchers. The proposed recommendations can help improve agrocluster activities, attract investment, increase exports, and ensure employment in agriculture. The research findings can also be used in implementing the “Uzbekistan–2030” Strategy, developing agricultural programs, and improving the regulatory and legal framework governing agrocluster activities.

Future research should focus on the following areas:

- assessing the environmental sustainability of agroclusters;
- studying the impact of digital technologies on agrocluster efficiency;
- examining the integration of small and medium-sized farms into clusters;
- developing ways to increase the export potential of agroclusters;
- conducting a comparative analysis of the economic efficiency of regional agroclusters.

In conclusion, the agrocluster system has become one of the most effective instruments for developing agriculture in Uzbekistan. Nevertheless, by studying foreign experience and implementing its positive aspects, it is possible to further improve agrocluster activities and increase their economic efficiency.

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