

Analysis of Agro-Service Provision and Resource Utilization Efficiency in Cotton-Textile Clusters

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Annotation: This article examines the current state of agro-service provision and resource utilization efficiency within cotton-textile clusters in Uzbekistan. These clusters integrate agricultural production and textile manufacturing into a unified value chain, aiming to increase productivity, reduce costs, and improve competitiveness. Based on empirical data from Fergana, Andijan, and Kashkadarya regions, the study identifies key disparities in the quality and availability of agro-services such as mechanization, irrigation, and input supply. The research also highlights significant inefficiencies in land, water, and labor utilization, especially in clusters lacking modern technologies. Comparative analysis between technologically advanced and traditional clusters demonstrates that digitalization, centralized service coordination, and smart technologies significantly enhance performance. The study applies both quantitative and qualitative methods, including statistical analysis, field surveys, and expert interviews. The findings emphasize the need for improved agro-service governance, investment in agri-tech

infrastructure, and stronger stakeholder coordination to unlock the full potential of cotton-textile clusters. Ultimately, enhanced agro-service delivery and efficient resource use are critical to achieving sustainable growth, higher yields, and increased export potential in Uzbekistan's agricultural-industrial complex.

Keywords: cotton-textile clusters, agro-service delivery, resource efficiency, Uzbekistan agriculture, mechanization, irrigation systems, digital agriculture, cluster development, agricultural modernization, public-private partnerships.

Introduction

In the modern agricultural economy, the integration of farming and industry through clusters has become an effective model for achieving sustainable growth. Cotton-textile clusters, in particular, have emerged as a strategic solution in many countries, including Uzbekistan, where agriculture and textile production are closely intertwined. These clusters combine the cultivation of raw cotton, its processing into yarn and fabric, and the final production of textile goods under one integrated system. The goal is to improve productivity, reduce costs, eliminate intermediaries, and increase the added value of end products. Agro-service delivery is one of the most essential components that supports the effectiveness of these clusters. Agro-services encompass a wide range of support functions, including the provision of mechanized equipment, irrigation systems, fertilizers, pesticides, agro-consulting, and maintenance services. In a successful cluster, agro-services must be readily available, efficient, and responsive to the needs of farmers and processors. A robust agro-service infrastructure ensures timely sowing and harvesting, increases yield, and minimizes post-harvest losses. Moreover, the effective utilization of internal resources within agro-clusters is equally crucial. These resources include land, labor, machinery, water, energy, and capital. Poorly managed or underutilized resources can significantly reduce a cluster's productivity and profitability. While Uzbekistan has made considerable efforts to modernize its agricultural sector through clusterization, disparities in agro-service delivery and inefficient resource use remain persistent challenges. This paper aims to examine the quality and availability of agro-service delivery in cotton-textile clusters and assess the efficiency of resource utilization. The focus is on identifying gaps, analyzing best practices, and providing evidence-based recommendations to enhance the performance of clusters. The research is based on empirical data from selected regions and uses statistical, comparative, and qualitative methods for analysis. By assessing both service provision and resource usage, this study offers a holistic view of the operational dynamics within cotton-textile clusters in Uzbekistan. It emphasizes the importance of well-organized agro-support mechanisms and resource optimization in achieving the economic potential of these integrated systems. Ultimately, improving service delivery and ensuring efficient resource management will support the broader goals of agricultural modernization, rural employment, and increased export capacity in Uzbekistan's cotton and textile sectors.

Methods

This study employed a mixed-methods approach combining both qualitative and quantitative data collection and analysis. Three regions were selected as the main sites for research: Fergana, Andijan, and Kashkadarya — each known for their high concentration of cotton-textile clusters.

Data Collection

Primary data was collected through field observations, structured interviews, and surveys involving cluster managers, service providers, and farmers.

Secondary data was obtained from official sources such as the State Statistics Committee of Uzbekistan, Ministry of Agriculture, and published reports by international organizations like the FAO and World Bank.

Quantitative Analysis:

Statistical tools were used to analyze data on:

Machinery availability (e.g., number of tractors and cotton harvesters per hectare),

Fertilizer and pesticide usage, Water resource allocation,

Labor productivity and yield outputs per hectare,

Cluster profit margins and production efficiency.

Qualitative Analysis:

Expert interviews and SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis helped evaluate:

Management practices in agro-service centers,

Bottlenecks in resource access, Challenges in service coordination across supply chains.

The study also included a comparative evaluation between clusters that use modern agro-technologies (e.g., drip irrigation, GPS-guided machinery) and those relying on traditional methods. The aim was to highlight performance differences linked to service quality and resource efficiency.

Ethical considerations were observed by obtaining verbal consent from all participants. The reliability of the findings was strengthened through triangulation—comparing data from multiple sources.

Results

The findings reveal significant variability in agro-service provision among the clusters studied. In Andijan, 85% of cotton producers had access to timely mechanized services, while in Kashkadarya, this number dropped to 52%, often due to equipment shortages and weak service coordination.

Regarding fertilizer and pesticide supply, most clusters relied on centralized distribution systems, but delays and mismanagement were common. Only 40% of farmers reported receiving their full input packages on time.

Water usage was another concern. In clusters using traditional irrigation methods, up to 30% of water was lost due to inefficiencies. Meanwhile, those using drip irrigation systems reported a 20–25% increase in cotton yield and lower water consumption. Resource utilization rates also varied. On average, clusters used only 65% of their total resource capacity. Clusters equipped with digital monitoring tools showed higher labor efficiency (1.8x) and better financial returns compared to those lacking technological support. Overall, the most successful clusters were those with a centralized agro-service center, well-trained technical staff, and financial incentives for adopting smart technologies.

Discussion

The study confirms that agro-service delivery and effective resource utilization are critical to the performance of cotton-textile clusters. Where agro-services were available, mechanized farming reduced labor needs, increased yields, and enhanced quality. Conversely, delays in service

provision and equipment shortages led to decreased productivity.

The efficiency of water and land resource use was also a major differentiator. Clusters adopting modern irrigation and precision agriculture technologies made better use of limited resources and achieved superior outcomes.

Moreover, the lack of coordination between stakeholders within clusters weakened service efficiency. In many cases, farmers were unaware of service schedules, and there was no digital tracking of inputs and outputs, leading to losses and inefficiencies. The research also highlights the importance of supportive policy environments. Clusters receiving targeted government support, including subsidized inputs and access to credit, performed notably better.

To improve the agro-cluster system, Uzbekistan should focus on:

Expanding public-private partnerships in service provision;

Investing in agri-tech infrastructure;

Building capacity among service operators and farmers;

Strengthening cluster governance through better coordination and digitalization.

Conclusion

Cotton-textile clusters in Uzbekistan represent a promising model for integrated agricultural-industrial development. However, the success of these clusters largely depends on two key factors: the quality of agro-service provision and the efficiency of resource utilization. This study demonstrated that inconsistencies in service delivery and underutilization of critical resources such as land, machinery, and water are major barriers to optimal cluster performance. At the same time, clusters that invested in smart technologies and centralized service systems achieved higher yields, better quality outputs, and greater profitability.

Policy reforms, investment in infrastructure, and improved coordination among stakeholders are necessary to enhance the performance of agro-clusters. A modern, responsive, and efficient agro-service system—aligned with the needs of farmers and processors—is essential for ensuring the sustainability and competitiveness of Uzbekistan's cotton-textile sector in the global market.

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