



Article

# Prospects for The Integration of Cotton Raw Material Production And Processing in Cotton–Textile Agro-Clusters

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**Abstract:** This article provides a scientific analysis of the mutual integration of cotton raw material production and its processing within cotton–textile agro-clusters, as well as the prospects for developing this integration. Particular attention is paid to the efficient use of land and labor resources within agro-clusters and to deepening the value chain from cotton cultivation to the production of finished goods. In addition, the study substantiates the possibilities of increasing economic efficiency, creating added value, and enhancing competitiveness as a result of the coordinated interaction between production and processing processes. The research findings have practical significance for making strategic decisions aimed at the sustainable development of cotton-textile agro-clusters.

**Keywords:** Cotton-Textile Agro-Clusters, Cotton Raw Material Production, Cotton Processing, Production, Processing, Integration, Value Chain, Labor Resources, Economic Efficiency, Added Value, Competitiveness, Sustainable Development

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## 1. Introduction

Across the world, trends aimed at the efficient use of the natural and economic potential of regions through organizing production on a cluster basis have been intensifying. In particular, in developed countries, the integration of production and service sectors within clusters, as well as the attraction of high technologies, ensures the sustainable socio-economic development of economic sectors and regions [1].

In the economy of Uzbekistan, the cotton-growing and textile industries are of strategic importance, as they play a leading role in increasing the country's export potential, ensuring employment, and promoting the socio-economic development of regions.

In recent years, special attention has been paid to deepening the integration of cotton raw material production and its processing through the establishment and development of cotton–textile agro-clusters. This creates opportunities for a gradual transition from a traditional raw-material orientation to the production of finished goods with higher added value [2].

At the same time, the institutional, organizational-economic, and technological mechanisms of integration between production and processing in cotton–textile agro-clusters have not yet been fully formed, and a number of problems and constraints persist in the functioning of this system. In particular, ensuring the stability of the raw material base, maintaining a balance of interests between farms and processing enterprises, efficient

use of resources, and the introduction of innovative and digital technologies require comprehensive scientific analysis.

Under these conditions, scientifically grounded research into the prospects for deepening the integration of cotton raw material production and processing in cotton–textile agro-clusters, as well as the development of practical proposals and recommendations aimed at improving economic efficiency, is of significant scientific and practical importance [3], [4]. Effective organization of such efforts will contribute to improving cluster policy in the cotton–textile sector, ensuring the sustainable development of regional agro-industrial systems, and enhancing the competitiveness of the national economy.

### **Literature Review**

As emphasized by the President of the Republic of Uzbekistan, Sh. M. Mirziyoyev, “our farmers and dehqan households are the main driving force in agriculture, and today we note with pride and gratitude that they are carrying out invaluable work not only in developing this sector, but also in advancing the entire country, improving the living standards of our people, and making our homeland prosperous in every respect [5], [6]. Our systematic efforts aimed at diversifying agriculture, using land and water resources more rationally, and increasing farmers’ incomes through the production of export-oriented products are also gradually yielding positive results.”

In the current era of globalization, the sustainable development of the national economy depends on intersectoral cooperation and coordination. In particular, the introduction of agro-clusters in the agricultural sector plays an important role in strengthening economic relations between different industries and improving overall efficiency. Cluster activities represent a multi-sectoral system that integrally connects agriculture, processing, logistics, education, finance, and other sectors.

An agricultural cluster implements an integration process based on the economic, technological, and innovative cooperation of interconnected production, processing, educational, research, logistics, and financial organizations within a specific territory [7].

An agricultural cluster functions as a unified economic ecosystem, in which each component serves the common objective of producing competitive products and ensuring sustainable economic growth.

The implementation of measures aimed at the widespread adoption of the cluster model in agribusiness, the improvement of the organizational, legal, and economic foundations of the clustering process, and the facilitation of investment projects for establishing and developing clusters in agricultural sectors constitute an important task [8].

Agro-clusters in Uzbekistan are actively functioning as a mechanism for the comprehensive modernization of the agricultural sector. First, they contribute to employment creation and increased labor engagement; second, they facilitate the introduction of innovative and intensive technologies; and third, they expand export potential and promote overall economic prosperity [9], [10].

“...In the United States, 380 clusters are in operation, accounting for 60 percent of GDP. In Italy, 43 percent of industrial employment is concentrated in 206 clusters, and these clusters account for 30 percent of the country’s exports. In China, more than 60 specialized clusters bring together nearly 30,000 enterprises and employ about 3.5 million people. These enterprises produce goods worth approximately USD 200 billion annually.” Thus, the development of this sector and the organization of agro-cluster activities as a new form of economic management make it possible to achieve high levels of efficiency.

## **2. Methodology**

In order to scientifically examine the mutual integration of cotton raw material production and its processing in cotton-textile agro-clusters, a comprehensive methodological approach was applied. The research methodology is based on the general principles of economic theory, the cluster concept, the theory of agro-industrial integration, and the principles of sustainable development.

During the research process, general scientific methods of cognition were widely employed, including analysis and synthesis, induction and deduction, comparison, as well as systemic and functional approaches. Through these methods, the organizational and economic structure of cotton-textile agro-clusters, the interconnection between production and processing processes, and their impact on economic efficiency were comprehensively examined.

### 3. Results and Discussion

In 2025, a total of 651 agro-clusters were operating in the republic, fully covering the main areas of agriculture, including cotton growing, grain production, and fruit and vegetable cultivation. Through these clusters, 100 percent of the cotton and grain produced in the country, as well as more than 40.0 percent of fruit and vegetable products, are generated. This indicates a deep institutional and economic integration of the cluster system in agro-industrial production.

Agro-cluster activities play an important role in attracting investment and creating new jobs. In particular, during 2020-2024, 245 investment projects with a total value of 134.2 trillion soums were implemented within cotton-textile clusters, resulting in the creation of 49.3 thousand new jobs. In addition, in 2020, 29 projects worth 774 billion soums were launched in 18 clusters focused on cotton processing, creating 6,300 new jobs. For example, an agro-cluster established in the Pakhtaobod district, covering 470 hectares, was financed by investments amounting to USD 30 million and provided employment for 2,000 permanent workers as well as a large number of seasonal workers [11].

Advanced agrotechnologies aimed at increasing yields and ensuring efficient use of resources are being widely introduced in agro-clusters. In particular, in the intensive orchards of the Mirzaobod agro-cluster, yields per hectare have increased by 5-6 times compared to traditional methods. In 2024, 66,000 plum seedlings were planted on 100 hectares within this cluster. At the same time, drip irrigation technologies have been introduced to conserve water resources, and a project worth 3 billion soums has been implemented in the Mirzaobod agro-cluster in this area.

Agro-clusters are also considered an important factor in increasing economic efficiency and export potential. In particular, in 2024, the volume of plums exported through agro-clusters amounted to 30,100 tons, with a total value of USD 24.3 million, which is approximately USD 4.1 million higher than in the corresponding period of the previous year [12], [13]. In addition, the volume of cotton fiber processing increased by 2.5 times, silk production doubled, and exports of finished textile products increased threefold, bringing the total annual export volume to USD 3 billion.

Within the agro-cluster system, the entire technological chain of production-from raw material cultivation to processing and access to external markets-is covered. This makes it possible to form a vertically integrated system based on the "field-to-consumer" principle [14]. During 2020-2026, the state allocated investments amounting to USD 600 million to deepen the vertical integration of agro-clusters and develop agrologistics infrastructure, while also placing strong emphasis on expanding agricultural service activities.

**Table 1.** Analysis of Land Area and Employment Indicators of Cotton-Textile Agro-Clusters in Kashkadarya Region

No	Enterprise name	Cotton cultivated area, ha	of which:		Total number of permanent employees, persons
			Area cultivated by farms under futures contracts for cotton raw material production, ha	Land area under the management of the cluster, ha	
1.	“Oq Saroy Cluster” LLC	10100	9506	594	576
2.	“Kitob Ip Yigiruv” JSC	6347	6122	225	550
3.	“Emg Inter Investment” LLC	4819	3498	1321	100
4.	“Naxshab TEX Group” LLC	6273	6 224	49	2750
5.	“Beshkent-Agro Cluster”	4403	4403	-	72
6.	“Bunyodkor” LLC	7586	6 546	1 041	900
7.	“Qamashi Tekstil” LLC	4126	4126	-	530
8.	“Qarshi Agrocluster” LLC	7 324	6 721	603	305
9.	“Cluster Khilol” LLC	4743	4670	73	350
10.	“Koson Bakht Tekstil” LLC	14414	14414	-	900
11.	“Mirishkor Ratex Tekstil” LLC	2872	2872	-	38
12.	“Mirishkor Tekstil Group Cluster” LLC	7803	6531	1272	120
13.	“Oq Saroy Textile” LLC	5024	5024	-	1400
14.	“Original Cotton Mirishkor” LLC	2976	2405	571	125
15.	“Semurg Agro-Tex” LLC	1431	1431	-	28
16.	“Sulton Golden Tech” LLC	4478	4478	-	300
17.	“Chiroqchi Cluster” LLC	8200	7362	838	355
18.	“Shodlik Cotton–Grain Cluster” LLC	3001	3001	-	96

Kashkadarya region is considered one of the most rapidly developing areas in the republic in terms of cotton-textile agro-clusters. The agro-clusters operating in the region integrate the cultivation of agricultural products, processing, and the production of finished textile goods into a single technological chain, thereby playing an important role in ensuring the sustainable growth of the regional economy. The data presented in the table make it possible to provide a comprehensive assessment of the characteristics of land resource utilization by these clusters and their role in ensuring employment.

The size of cotton-cultivated land areas managed by the 18 cotton-textile agro-clusters under analysis varies significantly. The minimum area amounts to 1,431 hectares, while the maximum reaches 14,414 hectares. This indicates differences in the territorial location, investment potential, production capacities, and organizational models of the clusters [15].

An analysis of the structure of land resources shows that the majority of clusters operate in cooperation with farms on the basis of futures contracts. For example, in “Oq Saroy Cluster” LLC, out of a total of 10,100 hectares of cotton land, 9,506 hectares are cultivated by farms. A similar situation is observed in large clusters such as “Kitob Ip Yigiruv” JSC, “Bunyodkor” LLC, “Qarshi Agrocluster” LLC, and “Chiroqchi Cluster” LLC. This practice contributes to the deep integration of farms into the cluster system, ensures guaranteed sales of agricultural products, and stabilizes income sources in rural areas.

In some clusters, cotton cultivation is carried out entirely on land managed directly by the enterprise. In companies such as “Koson Bakht Tekstil,” “Qamashi Tekstil,” “Oq Saroy Textile,” “Beshkent-Agro Cluster,” and “Semurg Agro-Tex,” production is organized without the participation of farms. This model ensures full control over land resources but requires significant capital investment and the application of efficient agrotechnologies.

One of the key functions of agro-clusters is to ensure employment. The table data indicate significant differences among clusters in terms of the number of permanent employees. The highest indicator is observed in “Naxshab TEX Group” LLC, which employs 2,750 permanent workers. This suggests that cotton processing and textile production, rather than cotton cultivation, are the priority activities in this cluster.

In addition, “Oq Saroy Textile” LLC employs 1,400 permanent workers, while “Bunyodkor” LLC and “Koson Bakht Tekstil” LLC each provide employment for 900 permanent workers. These clusters are characterized by labor-intensive processes not only in agriculture but also in industrial production stages.

In some small and medium-sized clusters, the number of permanent employees is relatively low. For instance, “Semurg Agro-Tex” LLC employs 28 permanent workers, and “Mirishkor Ratex Tekstil” LLC employs 38. This can be explained by a higher level of mechanization in production processes or the specialization of cluster activities in specific stages (Table 1).

The analysis results indicate that there is no consistent direct proportional relationship between the size of land area and the level of employment. In some cases, clusters with large land areas employ a relatively small number of workers, whereas in other clusters, high employment levels are ensured despite limited land resources. This reflects the specific stage of the production chain on which agro-clusters place greater emphasis—either primary raw material cultivation or its deep processing.

Overall, cotton–textile agro-clusters in the Kashkadarya region are of strategic importance in terms of efficient use of land resources, development of cooperation with farms, and ensuring employment. The cooperation model based on futures contracts contributes to increasing economic stability in rural areas, while land areas managed directly by clusters create opportunities for achieving high technological efficiency. From this perspective, improving the efficiency of land and labor resource utilization, increasing value added within the production chain, and strengthening social outcomes remain among the key priorities for agro-clusters in the future.

Cotton–textile agro-clusters operating in the Kashkadarya region represent important economic entities in the cultivation of agricultural products, their industrial processing, and the production of high value-added goods. The data presented in the table allow for a comprehensive assessment of the volume of cotton raw material produced by clusters, its sources, yield levels, and the structure of finished and semi-finished products obtained as a result of processing.

According to the analysis results, there are significant differences among clusters in terms of the volume of cotton raw material produced. The highest production volume is observed in “Koson Bakht Tekstil” LLC, amounting to 47,360 tons. In addition, “Oq Saroy Cluster” LLC produced 40,600 tons, “Qarshi Agrocluster” LLC produced 25,760 tons, and “Mirishkor Tekstil Group Cluster” LLC produced 24,633 tons, placing them among the largest producers.

The analysis of indicators shows that in most clusters the main share of cotton raw material is produced by farms. For example, in “Oq Saroy Cluster” LLC more than 75.0 percent of total production volume is accounted for by farms. This indicates the effective functioning of cluster–farm cooperation mechanisms and the growing role of the private sector in agricultural production.

In some clusters, however, production is carried out fully or almost entirely on land managed directly by the cluster itself. In enterprises such as “Beshkent-Agro Cluster,” “Qamashi Tekstil,” “Koson Bakht Tekstil,” and “Oq Saroy Textile,” a production model without the participation of farms predominates. This approach makes it possible to ensure stable production volumes through centralized management and agrotechnological processes.

Across clusters, yield levels range from 18.8 centners per hectare to 38.0 centners per hectare. The highest yields were observed in “Qarshi Agrocluster” LLC and “Beshkent-Agro Cluster” LLC (around 38.0 c/ha). This is explained by the application of advanced agrotechnologies, the use of high-quality seed material, efficient utilization of water resources, and the timely implementation of agrotechnical measures in these clusters.

Relatively low yields were recorded in “Sulton Golden Tech” LLC (18.8 c/ha), which may be associated with natural and climatic conditions, soil fertility, or technological constraints in production processes. Overall, yield indicators demonstrate significant differences in production efficiency among clusters.

The structure of products obtained as a result of cotton raw material processing clearly reflects the industrial potential of agro-clusters. On average, cotton processing yields 32.0 percent fiber, 53.0 percent cottonseed, 4.0 percent lint, 5.0 percent short fiber, and 6.0 percent waste.

**Table 2.** Production and Processing Indicators of Cotton–Textile Agro-Clusters in Kashkadarya Region

No	Enterprise name	Volume of produced output, tons	of which:		Yield, centners per hectare	Volume of products obtained from cotton raw material processing:				
			volume of cotton raw material produced by farms, tons	volume of output produced by the cluster, tons		fiber, tons (average 32.0%)	cottonseed, tons (average 53.0%)	lint, tons (average 4%)	short fiber, tons (average 5%)	waste, tons (average 6%)
1.	“Oq Saroy Cluster” LLC	40600	30835	9765	35	9867,2	16342,5	1233,4	1541,7	1850,1
2.	“Kitob Ip Yigiruv” JSC	13663	13190	473	21	4510	7104	547	683	819
3.	“Emg Inter Investment” LLC	15340	11112,8	4227,2	32	5062,2	7976,8	613,6	767	920,4
4.	“Naxshab TEX Group” LLC	23256	23134,7	121,3	24,7	8279	12186	683	953	1132
5.	“Beshkent-Agro Cluster”	16240	16240	-	38	5359	8445	650	812	974
6.	“Bunyodkor” LLC	23050	19625,1	3424,9	32,9	7 501	11 867	657	1 300	1 646
7.	“Qamashi Tekstil” LLC	13930	13930	-	34,6	4597	7244	557	697	836
8.	“Qarshi Agrocluster” LLC	25760	255468,6	2291,4	38	8724	13747	1057	1322	1586
9.	“Cluster Khilol” LLC	16912	16671,1	240,9	33	5581	8794	676	846	1015
10.	“Koson Bakht Tekstil” LLC	47360	47360	-	37	15628,8	24627,2	1894,4	2368	2841,6

11.	“Mirishkor Ratex Tekstil” LLC	9190	9190	-	30	3033	4799	368	460	551
12.	“Mirishkor Tekstil Group Cluster” LLC	24633	21543	3090,9	24,3	8129	12809	985	1232	1478
13.	“Oq Saroy Textile” LLC	16788	16788	-	30	5540	8730	671	839	1007
14.	“Original Cotton Mirishkor” LLC	9608	8237,6	1370,4	24	3171	4996	384	480	576
15.	“Semurg Agro-Tex” LLC	4436	4 436	-	30	1464	2307	177	222	266
16.	“Sulton Golden Tech” LLC	14555	14555	-	18,8	5181	7626	378	596	759
17.	“Chiroqchi Cluster” LLC	19432	17420,8	2011,2	24	6412	10104	777	971	1165
18.	“Shodlik Cotton-Grain Cluster” LLC	9409	9409	-	31	3105	4893	376	470	565

Large-scale processing volumes were recorded in “Koson Bakht Tekstil” LLC, where 15,628.8 tons of fiber, 24,627.2 tons of cottonseed, and substantial volumes of by-products were produced. Similarly high indicators were also observed in “Oq Saroy Cluster” LLC, “Qarshi Agrocluster” LLC, and “Bunyodkor” LLC (Table 2).

These data indicate that processing capacities have been established within clusters and that a high level of value added is generated along the production chain. In particular, secondary products obtained after fiber and cottonseed processing (lint, short fiber, and waste) also represent economically significant resources, enabling clusters to diversify their sources of income.

The analysis of indicators demonstrates that cotton–textile agro-clusters in the Kashkadarya region possess high economic potential in both production and processing processes. Through cooperation with farms, clusters are forming a stable raw material base, while processing capacities allow a large share of products to be processed within the region, thereby generating additional value.

At the same time, differences in yield and production efficiency indicators suggest the need for further improvement of agrotechnologies, the introduction of resource-saving methods, and the wider dissemination of best practices among clusters in the future. Overall, cotton–textile agro-clusters in the Kashkadarya region are emerging as a leading driver of the region’s agro-industrial development.

#### 4. Conclusions

The results of the conducted scientific research demonstrate that the integration of cotton raw material production and its processing within cotton–textile agro-clusters is a key factor in ensuring the sustainable development of the country’s agriculture and textile industry. The cluster-based approach, which integrates production, processing, logistics,

and export stages into a unified system, makes it possible to expand the value-added chain, improve the efficiency of resource utilization, and enhance product competitiveness.

Integration of production and processing in cotton–textile agro-clusters contributes to increasing the depth of cotton raw material processing, raising the share of finished textile products, and diversifying the export structure. The activities of integrated clusters are characterized by growth in labor productivity, reduction in production costs, and acceleration of technological upgrading.

At the same time, the research results indicate the presence of a number of systemic problems in the functioning of cotton-textile agro-clusters. In particular, imperfections in contractual relations between farms and processing enterprises, insufficient balance of economic interests, instability of the raw material base in certain regions, and limited access to innovative resources have a negative impact on the effectiveness of integration.

The prospects for deepening the integration of production and processing in cotton–textile agro-clusters are primarily associated with improving the institutional environment, ensuring the alignment of economic interests among cluster participants, expanding financial incentive mechanisms for farmers, and introducing innovative and digital technologies. In addition, the development of agrologistics infrastructure and support for the production of export-oriented finished goods contribute to enhancing the sustainability of integration processes.

Overall, the development of integration between cotton raw material production and processing in cotton–textile agro-clusters promotes effective cooperation among economic sectors, accelerates the socio-economic development of regions, and increases the export potential and competitiveness of the national economy. The scientific conclusions and practical recommendations derived from the research have both theoretical and practical significance for further improving cluster policy in the cotton–textile sector.

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