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# THE ECONOMIC CONTENT AND SIGNIFICANCE OF THE EFFICIENCY OF USING INNOVATIVE TECHNOLOGIES IN THE DIGITAL TRANSFORMATION OF AGRICULTURE

Togayeva Dilnoza Azamatovna,
PhD (Acting Associate Professor)
Department of Humanities and Social Sciences, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi

**Annotation:**
This article analyzes the economic content and significance of the efficiency of using innovative technologies in the context of agricultural digital transformation. The study explores opportunities for increasing productivity, improving resource utilization, and reducing production costs by integrating digital technologies into agricultural production processes.

**Keywords:** Digital transformation of agriculture, innovative technologies, digital technologies, agricultural technologies, digital agriculture, smart farming, drone technology, artificial intelligence (AI), Internet of Things (IoT) in agriculture, geographic information systems (GIS), automated monitoring, efficient use of resources, production efficiency.

Samarkand Region's economy considers agriculture as one of its strategically significant sectors. The agricultural sector's share in the region's Gross Regional Product (GRP) is traditionally high, reflecting not only regional but also national economic trends[1]. Agriculture primarily serves as a vital source for meeting the population's main food needs. At the same time, it provides essential raw materials for many branches of light and food industries. For instance, at the national level, agricultural raw materials account for 60% of all material costs in the textile industry, nearly 70% in the confectionery industry, and almost 80% in the oil, fat,

[1] **Agency of Statistics under the President of the Republic of Uzbekistan.** *Agriculture of the Republic of Uzbekistan, 2023: Statistical Compilation*. Tashkent: Agency of Statistics, 2024. — 160 p.

and dairy industries[2]. These figures clearly demonstrate the significance of the raw material base for processing enterprises in Samarkand Region. Therefore, without ensuring a stable and sustained development of agricultural production, it is difficult to achieve the full implementation of any socio-economic programs aimed at improving the standard of living of the population.

The important role of the agricultural sector in the region's socio-economic life is also evident in employment indicators. Currently, nearly 27% of the total employed population in the Republic of Uzbekistan is engaged in agriculture [1, p. 58]. This means that a significant portion of the working-age population in agricultural-rich regions, such as Samarkand, is involved in this sector. Consequently, the overall growth rate of the regional economy and the improvement in the well-being of workers are closely tied to the level of agricultural development.

The agriculture of Samarkand Region, although not as broadly diversified as industry, comprises two major traditional and interconnected sectors: crop production and animal husbandry. These main sectors, in turn, are divided into several sub-sectors, depending on the region's natural and climatic conditions, water resources, and historically established agricultural practices. Some of these include:

**The main directions of crop production in Samarkand Region:**

1. **Grain growing:** Mainly aimed at ensuring food security by cultivating winter wheat and barley under irrigation.
2. **Vegetable growing, melon growing, and potato production:** Serves to meet the daily needs of the population and provide raw materials for the processing industry. This includes growing vegetables (tomatoes, cucumbers, onions, carrots, etc.), melons (melons, watermelons), and potatoes.
3. **Horticulture and viticulture:** Orchards (apricots, peaches, apples, pomegranate, figs, etc.), which are a "calling card" for Samarkand Region and a significant export product, as well as vineyards (table and wine grape varieties).

[2] **Ministry of Economy and Finance of the Republic of Uzbekistan.** *Strategy for the Development of the Agro-Industrial Complex of the Republic of Uzbekistan for 2022–2030*. Tashkent, 2022. — 85 p.

4. **Cotton growing:** A traditional sector which, although its cultivated area has been somewhat optimized in recent years, still maintains its place in the region's agricultural sector.
5. **Forage crop production:** This involves growing alfalfa, maize (for silage), root fodder, and other feed crops to provide a strong fodder base for the livestock sector.
6. **Cultivation of medicinal and essential oil-bearing plants:** This direction is developing as a promising opportunity due to favorable natural conditions.

**The main directions in the livestock sector of Samarkand Region:**

1. **Cattle breeding:** Raising large and small horned cattle for both milk and meat production, and improving breeding practices.
2. **Sheep and Goat Farming:** Breeding sheep (including Karakul sheep) and goats in foothill and mountainous areas of the region.
3. **Poultry Farming:** Operations specializing in industrial production of eggs and poultry meat.
4. **Sericulture:** Rearing silkworms and producing cocoons based on mulberry plantations.
5. **Beekeeping:** Honey production by utilizing the rich diversity of the region's flora.
6. **Fish Farming:** Developing fish production in existing water bodies and artificial ponds.

The balanced and efficient development of these sectors plays a decisive role in further strengthening the economic potential of Samarkand Region, improving the well-being of its population, and ensuring food security.

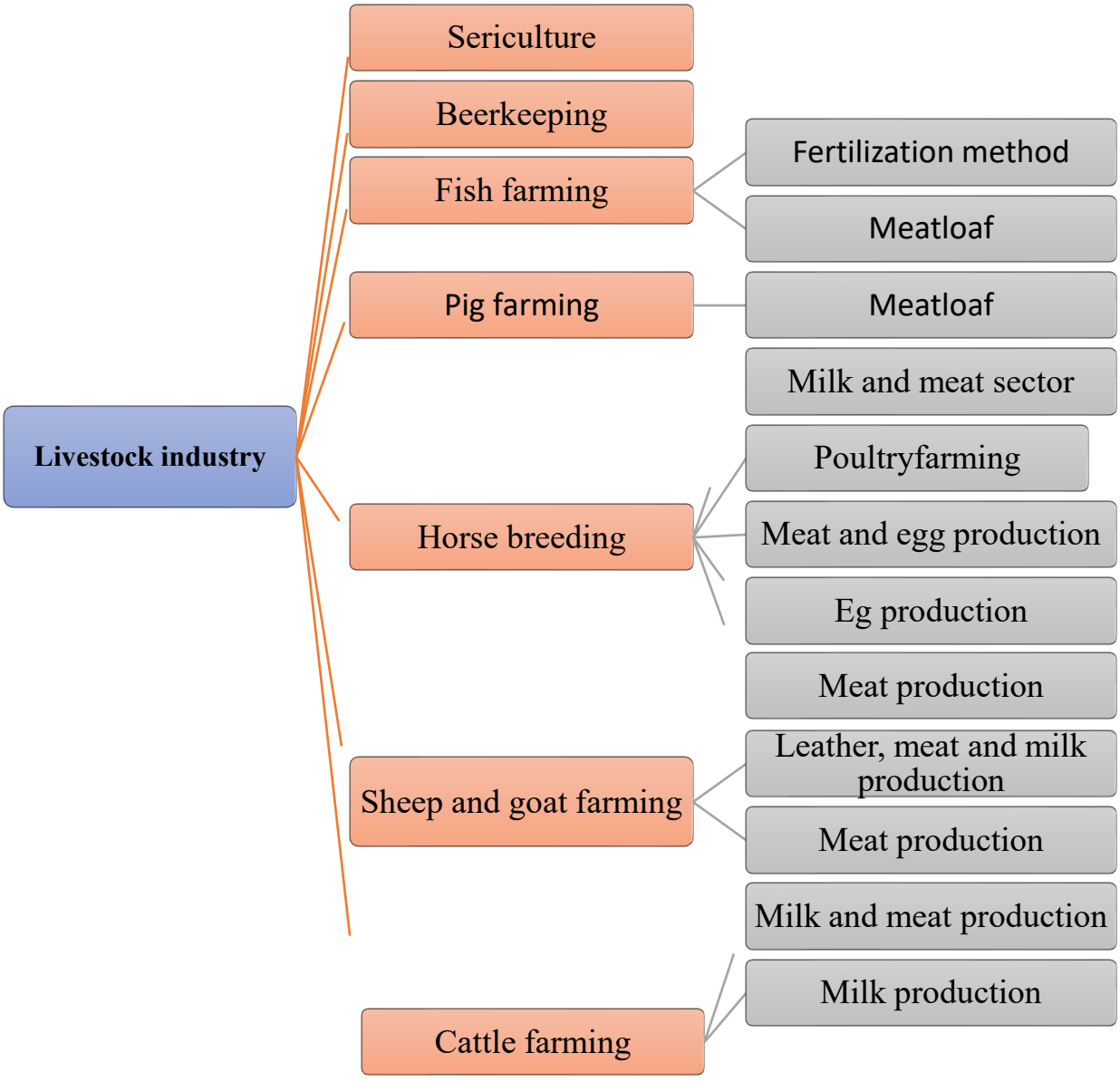


**Figure 3. Structure of Livestock Sector** [3]

The livestock sector in Samarkand Region plays a significant role in ensuring economic growth and food security. The overall trends in livestock production at the republican level also influence the sector's development at the regional level. For

[3] Source: Author's own compilation based on data

instance, during January–June 2024, the total volume of livestock products produced in the Republic of Uzbekistan amounted to 72.6 trillion soums, reflecting a growth rate of 102.0% in comparison to the corresponding period in 2023. During this period, the share of livestock products in the total agricultural output at the republican level reached 57.3%, demonstrating the sector's substantial role in the country's agricultural economy.

Samarkand Region is also one of the leading producers of livestock products in the republic. Consistent measures are being implemented in the region to modernize the sector, improve breeding practices, strengthen the feed base, and increase production volumes. According to official statistical data, by the end of 2023, a total of 272.1 thousand tons of meat (in live weight), 1,194.8 thousand tons of milk, and 803.3 million eggs were produced by all categories of agricultural enterprises in Samarkand Region. These indicators contribute not only to meeting the internal demand for major livestock products but also to strengthening the region's agricultural export potential.

Samarkand Region is also recognized as one of the traditional centers of sericulture, with special emphasis placed on the production of raw silk cocoons. During the first half of 2024, a total of 24.2 thousand tons of raw cocoons were produced across the republic, and a significant contribution is expected from the dehqan and farm enterprises of Samarkand Region. This, in turn, contributes to the creation of additional employment opportunities in rural areas and to increasing the incomes of the population.

Furthermore, measures are being implemented in the region to enable the sustainable development of all sectors of livestock production, including cattle breeding, sheep and goat breeding, poultry farming, and fish farming, as well as to improve breeding practices and increase productivity.

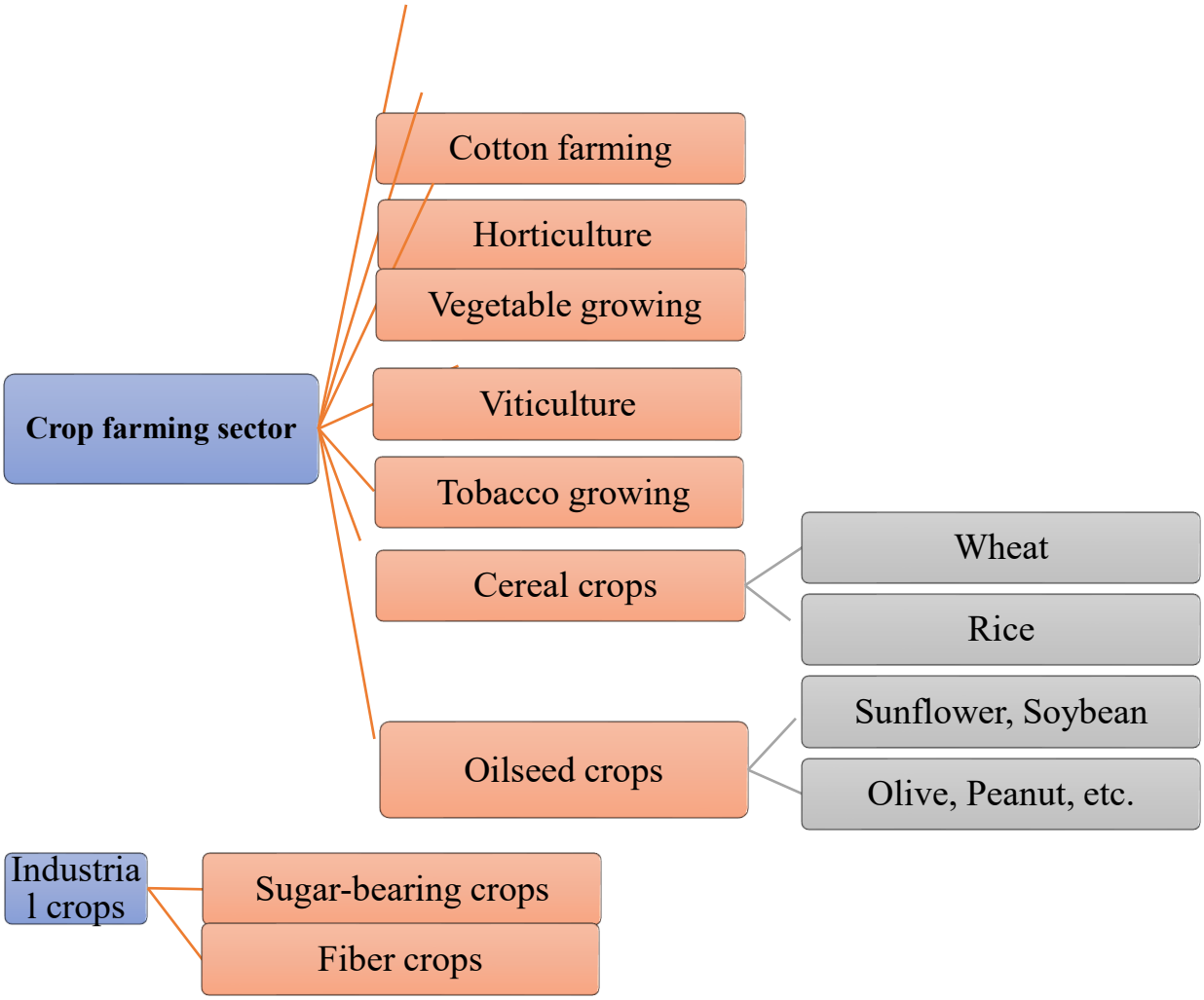


**Figure 4. Structure of the Crop Farming Sector** [4]

In Uzbekistan, the volume of agricultural products in 2024 amounted to 426.3 trillion soums, representing a 4.1% increase compared to 2023. It is noted that in 2024, livestock production in Uzbekistan reached 2.8 million tons of meat (live weight), 12 million tons of milk, and 8.5 million eggs. The volume of crop production in 2023 included: cereals – 8.4 million tons; potatoes – 3.6 million tons; vegetables – 11.6 million tons; melons and gourds – 2.4 million tons; and fruits and berries – 3.1 million tons.

[4] Source: Author's own compilation based on data

Table 3.1.1
Share of agriculture, forestry, and fisheries in the gross regional product by some regions*

| № | Name of the Region | Sector Output, 2023 (billion soums) | Sector Growth (2023/22, %) | Sector Share in Total (%, 2024+) |
|---|---|---|---|---|
| 1 | Andijan | 68,223.4 | 2.1% | 19.5% |
| 2 | Bukhara | 37,088.7 | 4.3% | 16.9% |
| 3 | Fergana | 22,746.2 | 3.9% | 35.5% |
| 4 | Jizzakh | 10,828.6 | 5.1% | 48.3% |
| 5 | Navoi | 11,224.4 | 1.9% | 13.9% |
| 6 | Kashkadarya | 41,646.0 | 4.5% | 22.6% |
| 7 | Samarkand | 20,455.1 | 4.8% | 39.7% |
| 8 | Syrdarya | 5,707.9 | 6.7% | 38.6% |
| 9 | Tashkent | 23,266.3 | 4.0% | 22.4% |

*"*Source: Data from the Statistics Agency under the President of the Republic of Uzbekistan"*

The role of agriculture, forestry, and fisheries in the economic development of Samarkand Region is significant, and analyzing their share in the Gross Regional Product (GRP) is crucial for shaping regional economic policy. According to some analytical data (for example, as shown in Table 3.1.1), among the regions of Uzbekistan, Andijan has the highest share of agriculture, forestry, and fisheries in its GRP, which amounted to 68,223.4 billion soums in 2024, representing a 2.1% increase compared to 2023, with a share of 19.5% in the GRP. In Samarkand Region, this sector's contribution reached 20,455.1 billion soums in 2024, showing a 4.8% growth compared to 2023, and its share in the GRP reached 39.7%. This indicator demonstrates the significant weight of the agrarian sector in the economy of Samarkand Region and underscores the need to ensure its sustainable development.

The modernization of agriculture through the introduction of innovative systems holds strategic importance. Specifically, Uzbekistan's agricultural development strategies envisage meeting a substantial part of the demand for agricultural products by 2050 (according to some forecasts, more than 90%) through innovative approaches. The concept of "digital agriculture" occupies a central role in this regard. Digital agriculture refers to the comprehensive application of modern digital technologies across all value chains of the agrarian sector.

Such transformations are also relevant for the agrarian sector of Samarkand Region. In particular, Internet of Things (IoT) technologies, various sensor devices measuring parameters such as soil moisture, temperature, and nutrient content, drones enabling precise monitoring of crop fields, pest control, and accurate fertilizer application, as well as robotic and automated systems (e.g., automatic irrigation or harvesting equipment) can be widely implemented. Additionally, digital solutions such as cloud computing technologies for processing and storing large volumes of data, and blockchain technologies for tracking product origin and movement are being applied to optimize agricultural production processes.

The digitization of agriculture in Samarkand Region is expected to lead to the following significant outcomes:

- **Increasing production efficiency:** Economical use of resources (water, fertilizers, fuel), improving labor productivity, and reducing production costs.
- **Enhancing crop yields:** Timely and quality implementation of agrotechnical measures, and reducing losses caused by diseases and pests.
- **Improving living standards in rural areas:** Creating new jobs, increasing the income of farming households, thereby contributing to poverty reduction.
- **Strengthening food security:** Stabilizing regional food supply and increasing export potential.

Thus, the widespread adoption of digital technologies in the agrarian sector of Samarkand Region should be regarded not only as a means to improve economic

efficiency but also as a priority direction that supports the region's socio-economic development and enhances the well-being of its population.[5]

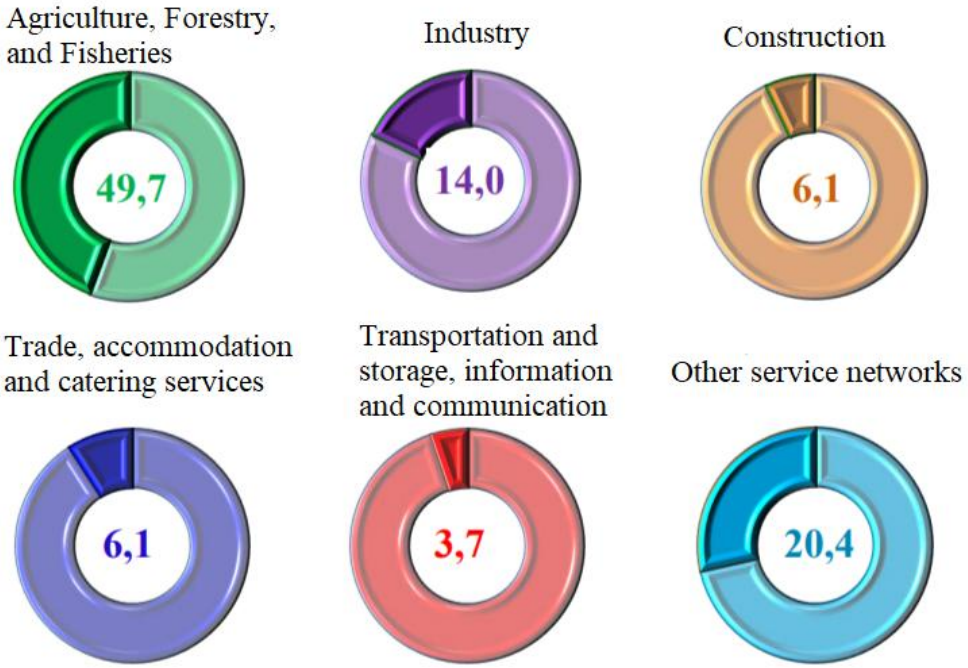


**Figure 5. The share of sectors in the production of Gross Regional Product (GRP) of Samarkand region by types of economic activity (2024)[6]**

As can be seen from the figure, agriculture, forestry, and fishing account for the largest share — 49.7% — in the production structure of the gross regional product (GRP) of Samarkand region.

[5] Kiambi D. The use of information communication and technology in advancement of African agriculture. Air J Agric Res. 2018;13(39):2025-36.

[6] Source: Data from the Samarkand Regional Department of Statistics

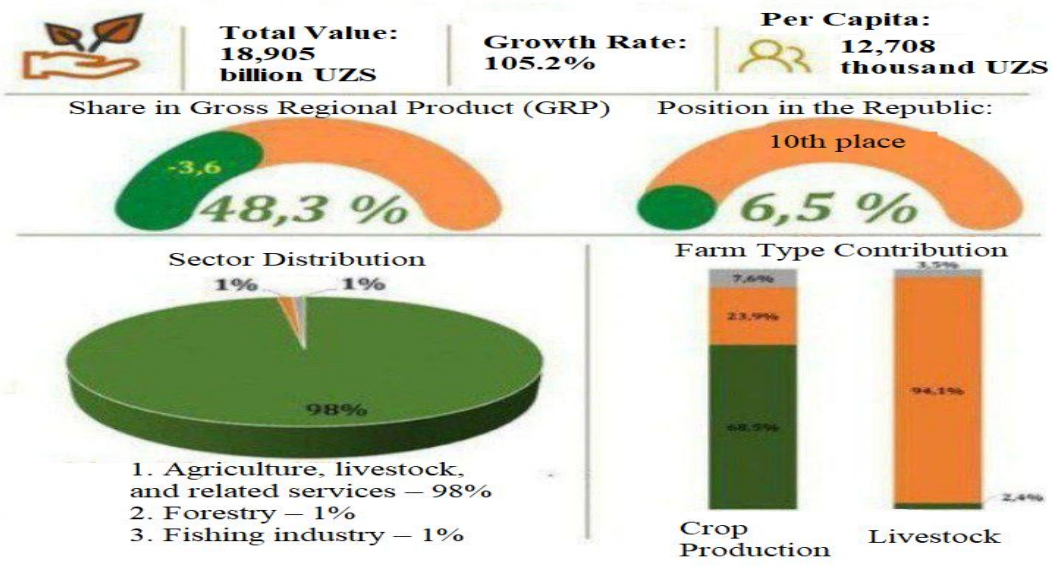


**Figure 6. Agricultural sector of Samarkand region (2024).**[7]

Samarkand region, as one of the major agrarian territories of the Republic, has been achieving significant results in the fields of agriculture, forestry, and fisheries. According to preliminary data from the Samarkand Regional Department of Statistics, in 2023, the total volume of products and services in agriculture, forestry, and fishing amounted to 48.5 trillion UZS at current prices. Of this amount, crop and livestock production, along with services in hunting, accounted for the largest share—47.99 trillion UZS. Forestry contributed 315.2 billion UZS, while the fisheries sector accounted for 223.4 billion UZS.

In 2023, the growth rate of agricultural production in the region was 104.1% compared to the previous year, and the region's share in the national gross agricultural output was approximately 11.5%, placing Samarkand among the leading regions of the country by this indicator.

Growth rates and efficiency indicators of agricultural production vary across different districts of the region. Notably, in districts with high agrarian potential—such as Pastdargom, Payarik, and Samarkand—the growth rates exceed the regional average. Traditionally, the share of agriculture in the structure of the gross regional

[7] Manba: Iqtisodiy tadqiqotlar va islohotlar markazi Samarqand filiali https://review.uz sayti ma'lumotlari

product (GRP) in Samarkand remains high, typically ranging between 28% and 30%.

In terms of agricultural output per capita, Samarkand region is also among the leading regions, with this figure estimated to be between 11.8 million and 12.5 million UZS. This indicator is significantly higher in some districts, such as Urgut and Oqdaryo, which are specialized in intensive crop farming and horticulture, while it is relatively lower in urban and industrialized areas.

In the overall formation of agricultural output, dehqon (peasant) and household farms play a major role, typically accounting for 65–70% of total production. The share of farms (fermer xo‘jaliklari) stands at around 25–30%, and that of agricultural enterprises at 3–5%. The share of small business in the agrarian sector is traditionally high, usually amounting to 98–99%.

In general, agriculture is a strategically important component of Uzbekistan’s national economy. It employs a significant portion of the country’s labor force (25–30%) and contributes substantially to the gross domestic product (GDP) (25–28%). Samarkand region actively participates in these national trends. In addition to cotton and grain production, the region has witnessed dynamic growth in fruit and vegetable farming, viticulture, and potato cultivation.

In conclusion, in recent years, the negative consequences of global climate change — particularly the intensifying water scarcity in the Zarafshan River basin, which is of vital importance to Samarkand region — the decline in soil fertility, and the spread of crop diseases and pests have posed serious threats to the sustainability and productivity of agriculture. These factors may adversely affect the incomes of farmers and dehqon (household) farms.

In the face of current ecological and economic challenges, the widespread adoption of water-saving technologies, elements of “smart agriculture,” and other digital solutions in Samarkand’s agricultural sector is becoming increasingly urgent. Such measures are essential for ensuring the efficient use of resources, increasing productivity, and enhancing the sector’s resilience to climate change.

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